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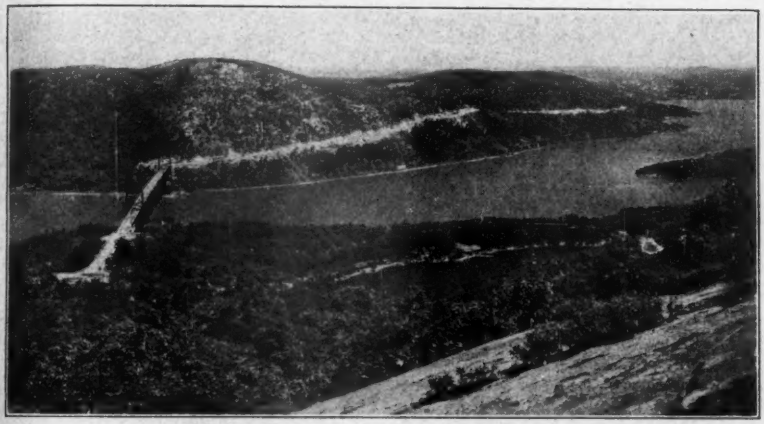

Courtesy of Bear Mountain Bridge Co.

View looking east from top of Bear Mountain, Orange County, New York, showing Bear Mountain Bridge spanning the majestic Hudson and Anthony's Nose towering abruptly above its eastern approach. Anthony's Nose will be the mecca for mineral lovers on July 9th when on this date collectors for miles around will trek to the Pyrrhotite Mine located about a mile and a half in from the river and on its northern flank. The city in the distance, on the extreme right, is Peekskill. Hessian Lake is in the central foreground. (The road at the foot of Anthony's Nose has been extended north since the photo was taken).

SUMMER DAYS ARE HERE AGAIN

-- BUT --

DON'T FORGET THE OUTING

JULY 9th

See Ad. Page 10 for official Program

A NON-TECHNICAL MAGAZINE

—ON—

MINING - PROSPECTING - GEOLOGY - MINERALOGY

THE BULLETIN BOARD

MORE ABOUT A MONTHLY

Most of our subscribers are well aware that a drive for a monthly is now in progress and we are pleased to advise results so far are very encouraging. No drive, contest or any other feature in the past had stirred up as much interest and enthusiasm as the present drive is doing. Prospects are good, therefore, for the magazine to come out monthly beginning with the September issue.

But these prospects are based upon the hope that those who have not as yet given us their support may do so by July 1st.

In our great voting contest which closed December 31, 1932, and in which granite and gold won national honors, many of our subscribers and friends won honors too by the active part which they played so that the contest could be a success. We are pleased to announce their names and the number of votes (100 or more) which each secured.

1. Mrs. Edna M. Scott, Custer, S. D.....3015
2. Rev. Father F. E. Bogner, Hoboken, N. J.....1132
3. W. H. McClelland, M.S., A.M., Tuckahoe, N. Y. 383
4. Benedict P. Bagrowski, Milwaukee, Wisc..... 349
5. Miss Helen Bybel, Peekskill, N. Y..... 321
6. Kenneth L. Renoll, Hanover, Penn..... 275
7. Dr. Henry C. Dake, Portland, Ore..... 216
8. Sister M. Catherine, New England, N. D..... 100
9. C. A. Evinger, Paris, Ill..... 100

To these warm friends of ROCKS AND MINERALS, our most grateful thanks are herewith extended.

WANTED: Correspondents in all parts of the world who will be kind enough to send us notes and news items on minerals, etc., that they think may be interesting to the subscribers of ROCKS AND MINERALS. Such as are available we shall be very glad to print in the magazine.

ROCKS and MINERALS

A NON-TECHNICAL MAGAZINE
—ON—
MINING—PROSPECTING—GEOLOGY—MINERALOGY

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ROCKS AND MINERALS PEEKSKILL, N. Y., U. S. A.

The Official Journal of the Rocks and Minerals Association

P. S.—Saw your Ad. in Rocks and Minerals

ROCKS and MINERALS

Edited and Published by Peter Zodac

PUBLISHED QUARTERLY

JUNE 1933

The Anthony's Nose Pyrrhotite Mine

—*By*—

PETER ZODAC

Editor, Rocks and Minerals

(With the collaboration of R. H. Ewell in the microscopic identification of minerals.)

You would look in vain for the pyrrhotite mine were you to come to Peekskill with the express hope of visiting it, and not knowing its location, were to ask for it by name. No one would be able to help you with directions. Even those "old timers" who have roamed the woods and mountains from one end to the other and back again, and who literally know every inch of the ground, would shake their heads in perplexity and say they never heard of it. "We have a lead mine, a copper mine, many iron and emery mines, and even a gold mine but no—what did you call it mine? Well, no matter, it ain't around here." You might be discouraged and crestfallen with this disheartening news and feel your trip would turn out a complete failure. But if you are familiar with old mines you would take the news calmly, as many of them have the annoying habit of becoming "lost". Perchance you might even consider a visit to one of the other mines worthwhile, to compensate you for the loss of what would have been an interesting visit to the pyrrhotite mine. Should the copper mine be your choice, then listen carefully to directions as they will lead you to the pyrrhotite mine. For the copper mine and the pyrrhotite mine are one and the same. Whether pyrrhotite was a word too difficult to remember or to pronounce, or whether because of the minute traces of copper present in the ore the word "copper" became affixed in the people's mind as the correct title for the mine is hard to say. However that may be, almost everyone around Peekskill, be he young or old, knows or at least has heard of the copper mine. For it is a noted objective for hikers and others who love the outdoor life. Indeed, we can safely announce that it is considered a mark of distinction around Peekskill for one to say "I've been to the copper mine."

History

The pyrrhotite mine is an old workings. When, how and by whom it was opened up has been lost in antiquity. From the works of early authors, it appears that the mine was first opened up for its iron content. In his references to the iron mines and iron ore occurrences of New York State, Beck[1] said:

"To these it may be added, that a bed of the same ore was, many years since, opened on Anthony's Nose on the Hudson river, but it contained much iron pyrites, and was not, it is believed, thought to be of much value." (p. 12).

He also reported two minerals as occurring there as follows:

"Apatite, in low six-sided prisms truncated on the terminal edges, has been found at Anthony's Nose. These crystals are of a brownish or yellowish green color, and vary from half a line to an inch in length. They are either perfect or have their angles rounded and generally present two faces broader than the other four. This locality is believed to have been first noticed by Dr. G. Troost." (p. 243).

"And the hepatic variety (of iron pyrites) is said to have been found in large quantities at Anthony's Nose, mingled with common pyrites and phosphate of lime." (p. 391).

Mather[2] devoted a little more attention to Anthony's Nose as he not only listed a number of minerals as occurring there but also stated that three mines were to be found.

"In Putnam County, there is a locality of sulphate of alumina and iron, and of sulphate of iron, in Phillipstown, on Anthony's Nose Mountain, about three miles from West Point, at an old iron mine where the ore contains pyrites. The earth from this place was used many years since by some of the inhabitants for dyeing. (p. 84).

Many localities might be mentioned in Putnam County, where pyrites decomposes with the formation of the sulphate of iron. The principal that have not been mentioned are.

1. An old iron mine on Anthony's Nose Mountain, about one and a half miles east of Fort Montgomery.

2. An old "silver mine" (but which contains no silver) on the top of the same mountain, three miles east of Fort Montgomery. (p. 117).

A bed (of magnetic oxide of iron) was opened many years ago on Anthony's Nose Mountain, but it contained much pyrites and crystallized phosphate of lime, both of which injure the ore for the manufacture of iron." (p. 560).

It is evident from Mather's references that the iron mine of his time is the pyrrhotite mine of today. For magnetite in large amounts is very common on the dumps and even outcrops close to the surface at the flat inclined shaft. So the pyrrhotite mine must have been first opened up—over 100 years ago—as an iron mine, but due to the large amount of impurities present, chiefly pyrite and apatite (phosphate of lime), which was injurious to the ore, it had to be abandoned. Later it was reopened and the pyrrhotite became the ore and was mined for its sulphur content. The mine was also known as the Phillips Pyrite Mine.

Location

The mine is situated on the northern flank of Anthony's Nose, at an elevation of approximately 700 feet above sea level and at a distance of about one and one-half miles almost due east from the eastern approach to the Bear Mountain Bridge, and about three miles northwest from the business section of Peekskill. The Westchester-Putnam County Line runs through the property. The workings, shafts, and pits are in Westchester County, the tunnels and dumps are in Putnam County.

The mine is in a wild and isolated country and can be reached via a poor dirt road called the Manito Road. Its nearest railroad station is Manitou, a mere hamlet, about one and a half miles almost due west, which in turn is about a mile north of the Bridge.

To reach the mine, one has a choice of two routes, both of which are concrete highways running north and south and parallelling each other. Manito Road

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[1]Beck, Lewis C., M. D. *Mineralogy of New York.* Albany, 1842.

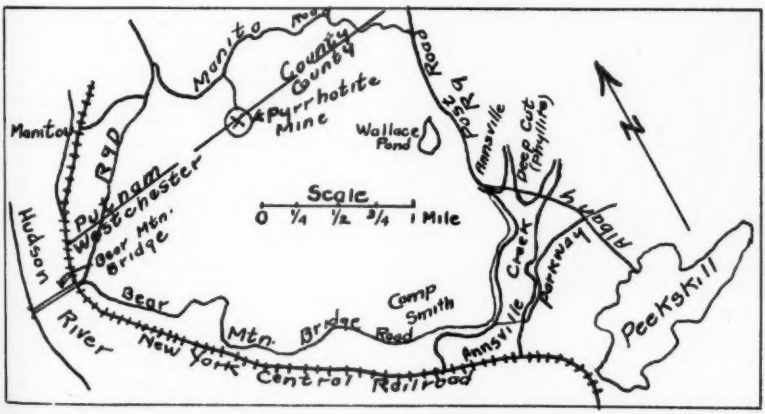
[2]Mather, William W. *Geology of New York, Part I, Comprising the Geology of the First Geological District,* Albany, 1843.

runs east and west off these two highways. In coming over the Bridge, one should turn left at its eastern approach and go north for a distance of 1.5 miles, (at 1.3 miles a road leads off to the left to Manitou Station) until a little white house with a sign—Ye Olde Oakside—is seen on the right. Turn right on the dirt road. Three dirt roads will branch off this dirt road at distances of .15 mile, .45 mile (very poor and may not even be noticed) .8 mile (the Military Road), and then the fourth or the mine road at .9 mile. A small pond about 50 feet in on the mine road and to its left serves for its identification.

In going from Peekskill, one takes the Albany Post Road and at the northern extremity of the city a very deep cut in phyllite is seen practically midway between two small concrete bridges about two hundred feet away. At a distance of 1.45 miles from the beginning of this cut a dirt road leads off to the left and for a short distance parallels the highway. A street sign informs one that it is the Manito Road. Just .3 mile north from this point is the Westchester-Putnam County Line, and a small sign to the left of the highway and at the base of the retaining wall of Musil's Chateau shows where the line crosses the highway.

The mine road is 1.6 miles in from the highway, but Manito Road unfortunately is not only in a very poor condition but is steep and narrow as well. However, it can be traversed with care. The mine road is the first road to branch off to the left and the small pond easily identifies it. The mine is in about 1,000 feet from Manito Road, but if the Manito Road was poor the mine road is even worse. It is an up-grade all the way and full of ruts and boulders, but a careful driver can travel it.

The first view of the mine is not an encouraging one. Two large mine dumps loom up suddenly in what appears at first glance to be a very desolated region, and though the dumps contain plenty of material the rocks seem either to be much disintegrated or else heavily stained with black and other colors. If the day is hot the sulphur fumes from the disintegrating ore makes the day even hotter, and the first inclination is to turn back in disappointment. Then added to all this is the lack of drinking water on the property. However, as one becomes more familiar with the locality and refuses to become discouraged by the apparent unfriendliness of the surroundings, then interesting specimens seem literally to pop out of the ground, and at each repeated visit more and more and often newer specimens can be collected. It was not until the writer made at least five visits within ten days to the locality, that the wealth of its specimens and the beauty of its surroundings began to dawn on him. Since then the pyrrhotite



Location Map showing Pyrrhotite Mine in relation to Peekskill and the Bear Mountain Bridge.

mine has had a more fascinating hold on him than any other locality has ever had.

From the top of the main shaft, a nice view of the Hudson River can be obtained, while Highland Falls and West Point can be seen in the distance. The mountain to the north and at whose base is Manito Road is Canada Hill. North Mountain is 1200 feet to the west of the mine while Mine Hill is the small prominence forming the southern boundary of the mine. As has been said, the mine is not very attractive in the summer time when the days are hot and close, but in the cooler periods of the year a visit to it is delightful.

View looking north showing the main dumps—right center—and a glimpse of the Hudson River. Three counties are visible, Orange County in the extreme background (across the river), Putnam County this side of river and in back of the collectors (author, left, and Ramon Conover, right), and Westchester County in immediate foreground.

Layout

The mine has been opened up by two tunnels and one steeply inclined shaft. Two other shafts, one a vertical and the other a flat inclined shaft, are also present and in close proximity to the main shaft. Seven prospect pits of which two are very shallow may be found to the west of the shafts, of which the farthest is 500 feet away.

The upper tunnel is 68 feet long, 5x6 feet in area and contains no timbering. Its portal is 56 feet below and 70 feet to the north of the outcrop, and the lower tunnel is approximately 300 feet long and its portal is 120 feet below and 305 feet to the north. Due to the depth of water in the lower tunnel it cannot be entered. A small post can be seen a short distance in from the portal.

The main shaft is approximately 20 feet in diameter and must be at least 100 feet deep to top of water. Because it is inclined, its true depth cannot be directly ascertained. It contains no timbering. At the surface it has caved in and 24 feet below merges with the large room described further on.

The vertical shaft is 20 feet in diameter, 36 feet deep and contains no timbering. The flat shaft is 36 feet long, 4x4 feet in area and contains no timbering. Both these shafts terminate in the smaller part of the large room described further on.

The mine originally must have consisted of two levels, the upper level opened up by the upper tunnel and the lower level by the lower tunnel. It may contain one, two or even more lower levels, but as the workings are full of water the mine in its entirity cannot be examined. The lower tunnel cannot even be entered due to the depth of water right at its portal. Nevertheless, soundings were made from the end of the upper tunnel and 23 feet of water was found, but as the ore pitches 70 degrees, the true depth could not be ascertained. This would indicate, however, that at least one more level is present which evidently was opened by means of the main shaft.

The two upper levels have merged together forming one large room or chamber of which the larger part is 150x20x85 feet deep to top of water, the smaller part being 30x30x12 feet deep. A small prov-

ing hole, 15 feet long, whose face is in solid granite, runs west off this. The floor of this small room is the bottom of the vertical shaft and evidently coincided with the floor of the upper tunnel.

The upper tunnel is very dangerous to enter by one inexperienced with mining conditions. Because it terminates abruptly in a vertical drop of 60 feet to the water below. There is no guard rail or any warning sign to protect one. Indeed, some few years ago a professor with a party of students visited the mine and this tunnel was entered. Due either to the fact his light was weak or else it went out unexpectedly, and the tunnel being only 68 feet long, the professor stepped out into space and fell to his death below. It was like walking off the face of a vertical cliff in pitch darkness.

No building or even ruins of an old building is to be seen at the mine. Nor are there any old machinery, mine cars or tracks present. Only the dumps, tunnels and shafts are left to remind one of activities long since abandoned. A few stone foundations, on the outskirts of the mine, with a small one between the two tunnels, are grim reminders of buildings of a once flourishing mine.

Geology

The ore body is apparently a lens in form, with a uniform thickness of 20 feet, and with an approximate dip of 70 degrees to the northwest. Its strike is 50 degrees N.E.—S.W. The deposit has been mined for 180 feet on the strike, but its distance on the dip cannot be ascertained due to water being present. Its depth from surface to top of water is 120 feet. Kemp[3] reported that it was said to be 300 or 400 feet down. Loveman[4] states it to be over 100 feet. The mine evidently must have been full of water even at that time so that its true depth could not be measured.

The ore is mainly pyrrhotite but pyrite, magnetite and chalcopyrite are also present. Hornblende and feldspar with some quartz are the chief minerals of the gangue. An analysis of the ore by Kemp[5] gives Sulphur 30%, copper 0.5%, and nickel 0.3%.

Loveman[6] says that the original owners had hopes that the ore might become richer in copper in depth, after the manner of the deposits at Ducktown, Tenn. They also entertained hopes of extracting payable amounts of nickel, but neither of these expectations were realized. Again, states that sulphur was the only product from which any returns were realized, and owing to the fact that no trace of arsenic was present in the ore, a C.P. acid could be made from the fumes. He also states that acid works were constructed on the shore of the Hudson River and were for some time supplied with ore from the mine, and that the mine had been idle for many years. The acid works are no longer in existence but the writer has dim recollections of seeing them in Mantou, in his younger days.

For the geology of the mine, the writer can do not better than to quote extracts from Loveman's[7] report. He says that the orebody is entirely enclosed in igneous rocks and that the rocks in the district surrounding the mine are granitoid, gneissoid and schistose with a wide range of mineral composition, and with origin which were in some cases undoubtedly igneous, in others sedimentary, and in still others indeterminable. Further he says:

"The wall rock directly adjacent to the ore on both the hanging and footwalls is a medium gray granitoid rock. It consists largely of plagioclase and pyroxene with varying amounts of quartz, orthoclase and various secondary and accessory minerals ..... The rock is a pyroxene diorite.

The rock at the mouth of the upper tunnel ..... is radically different in appearance from that immediately enclosing the ore. While the latter is a massive granitoid rock this is strongly gneissoid with well-defined bands of feldspar and hornblende. A microscopic examination

[3]Kemp, J. F. *Pyrrhotite Deposits at Anthony's Nose on the Hudson, N. Y.* Am. Inst. Min. Eng. Trans. 1894 p. 620.

[4]Loveman, Michael Heilprin. *Geology of the Phillips Pyrites Mine near Peekskill, New York.* Economic Geology, Vol. VI No. 3, April-May, 1911, p. 235.

[5]Kemp, J. F. Work Cited, p. 620.

[6]Loveman, M. L. Work Cited, p. 235.

[7]Loveman, M. L. Work Cited, pp. 236-246.

shows that it is composed essentially of feldspar and hornblende. The feldspar is present both as plagioclase and orthoclase in about equal amounts..... The amounts of plagioclase and orthoclase are so nearly equal that the rock can best be described as a basic mozonite metamorphosed to a monzonite gneiss.

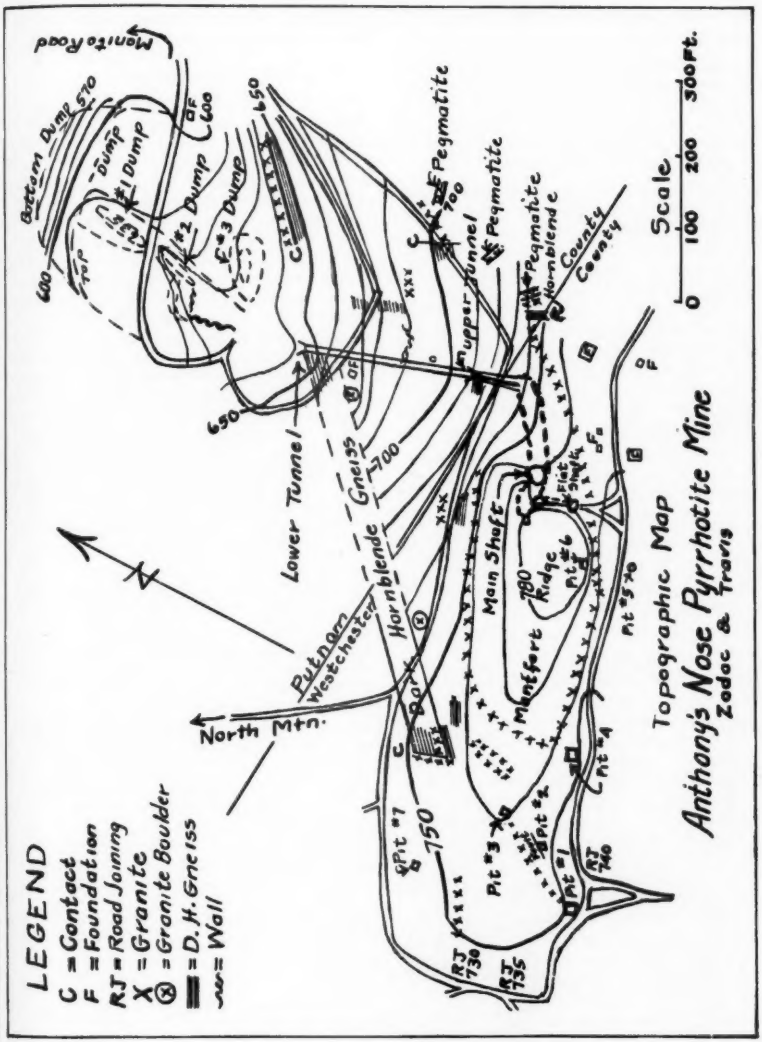
The rock at the mouth of the lower tunnel closely resembles that from the upper. Alteration of the original minerals and consequent formation of secondary products has, however, taken place to a greater degree .....

The rocks just described are either directly adjacent to the ore body or else they occur parallel to the deposit along the northwest side and not more than a few hundred feet from it. Farther from the ore body, and both to the north and south of it, is a fine grained granite or quartz diorite. This rock covers a much wider area than either of the others and appears to be the real country rock of the neighborhood, the more basic ones just described being intrusions in it.....

The following explanations seem best to account for the observed facts. The country rock of the district, which has been designated as a granite or quartz diorite, but which may possibly have been an impure sandstone, has two distinct masses intruded into it. First, the strongly gneissoid rock which has been called a rather basic monzonite appeared. Following this the district was subjected to dynamic disturbances which produced the strongly gneissoid character of the intrusion and which may have produced the same structure in the granitic country rock, or, if the latter was originally a sediment, may have converted it into its present condition. This last change may, however, have antedated this period and have been simply accentuated by it. At some later date, the pyroxene diorite, the wall rock of the mine, was intruded along the contact between the monzonite and the gnessoid granite. That this second intrusion is separated from the first by a period of disturbance is shown by the strongly gnessoid nature of the monzonite as contrasted with the very massive character of the pyroxene diorite. That these two intrusions were derived from the same source seems quite probable as the most marked differences between them are textural rather than mineralogical. The monzonite along the border near the pyroxene diorite has developed a coarsely pegmatitic phase, consisting largely of hornblende and feldspar, sometimes grading into almost pure massive hornblende. At some indeterminable period in its history this second intrusion was broken by a fault or more properly, by a crushed zone. Along this crushed zone, waters arose carrying pyrite in solution. The pyrite was deposited in the cavities and interstitial spaces of the shattered rock and in part replaced the silicates of the diorite. Following this period further shattering took place and the pyrite was in turn broken up, making room for the pyrrhotite which was then deposited in the same manner as the pyrite had been before, but in greater amount. The magnetite appears to have formed at some intermediate stage between that of the pyrite and the pyrrhotite. Just at what period the precipitation of the small amounts of chalcopyrite should be placed could not be determined, but it was probably simultaneous with the formation of the pyrrhotite. Quartz, probably partly derived from below and partly from the rock iself, was being introduced and rearranged during the whole process of the vein formation.....

The introduction of the sulphides was not entirely confined to the shattered zone. The mineral-bearing solutions invaded the wall rocks and penetrated a short distance into the monzonite to the northwest of the ore body. That this invasion was, however, limited in extent is shown by the fact that the rock at the mouth of the upper tunnel, about 100 feet from the ore body, is quite rich in disseminated sulphides while that from the mouth of the lower tunnel, about 300 feet distance from the ore, is practically free from them.

The fact that the pyroxene is free from sulphides and contains smaller amounts of the included quartz, falls in very well with the genesis outlined above. For, if it is assumed that the deposit was formed by infiltration along a shattered zone, it is only along this zone that the introduced minerals, the sulphides, and to a lesser extent the quartz, should be found. It is probable, however, that the pyroxene diorite was a line of weakness and that the shattered zone followed along it, at-



taining its maximum development at the site of the ore body, but having smaller local development at other spots, which became places of slight mineralization. It was at these slightly shattered spots that the test pits have been sunk along the strike of the diorite but as was evidenced by a microscopic examination, the shat-

tering was not pronounced enough to allow the introduction of appreciable amounts of sulphides.

The ultimate source of the ore cannot be stated with any approach to certainty, but the most reasonable supposition is that it was derived from the same magma as the pyroxene diorite itself, probably as an expiring manifestation."

Besides the rock formations described above, three other types are also present. An albite porphyry, five feet thick and much altered, outcrops on the west of the entrance to the upper tunnel and twelve feet from its portal; four pegmatite dikes, averaging eight feet in thickness outcrop about 125 feet to the east and southeast of the upper tunnel; and mica schist must evidently have been cut through in the lower tunnel as specimens have been found on the dumps. No schist is present in the upper tunnel.

Faults are numerous but do not appear to be of any magnitude. Perhaps the one most noticeable is at No. 2 pit.

Contacts are also numerous but the best occurrence is to be seen 100 feet north of No. 3 pit where a granite dike has cut through the dark monzonite gneiss.

The rocks in the district are heavily glaciated and many exposures are to be found at and around the mine with surfaces showing glaciation—smoothed and polished. The monzonite gneiss, for example, is glaciated for its entire length.

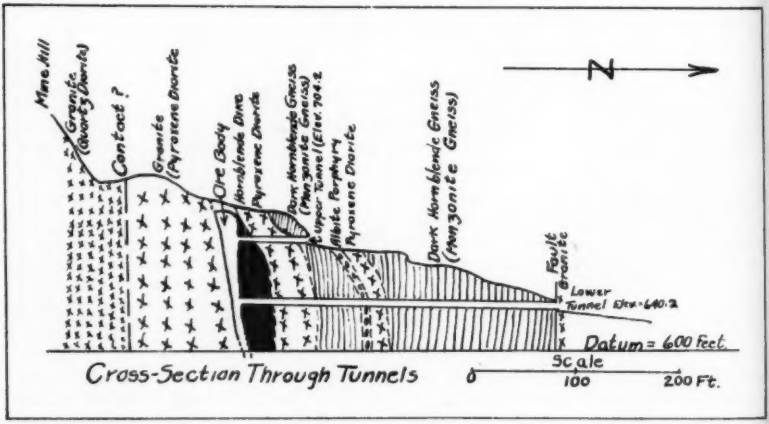
Mineralogy

Although a large number of minerals can be found here, they are of a quality not very suitable for a collection. Either they are disintegrating or else heavily stained. Crystals, if found, may be either bruised or shattered. Nevertheless, with patience and care, interesting specimens may be found and often of a type or quality as to surprise one. Barite, in amygdaloidal form and of rare occurrence anywhere, has been found but only one specimen; crystallized titanite of good quality is another; but the best find of all was langite, as this represents the first occurrence of the mineral in America. As far as is known the mineral has heretofore been found in only one locality in the world—Cornwall, England.

Whitlock[8] lists amphibole, apatite, calcite, chalcopyrite, magnetite, pyroxene and pyrrhotite as being found here. Manchester[9] adds to this list epidote, garnet,

[8]Whitlock, H. P. *List of New York Mineral Localities.* New York State Museum Bulletin 70 (Albany), pp. 94, 95 (1903).

[9]Manchester, James G. *Minerals of New York City and Its Environs.* Bulletin of the New York Mineralogical Club (New York City), Vol. 3, No. 1, p. 64 (January, 1931).



The lower tunnel cannot be entered and the formations shown are assumed to be as indicated.

limonite, molybdenite, natrolite, oligoclose, pyrite, quartz (drusy) and stilbite but places them under Anthony's Nose. And Anthony's Nose covers a lot of ground and contains a number of mineral localities of which the pyrrhotite mine is one.

All the minerals listed below have been found by the writer (PZ) or by Mr. Charles Travis (CT) who accompanied him on every trip since Sept. 9, 1932. Consequently they represent specimens that can be found now. At least one thousand specimens have been collected and examined.

Albite:—The most common of the feldspars present is albite which often is found in large cleavable, greenish masses with black hornblende. The black of the hornblende contrasts pleasingly with the green of the albite, so that a combination of the two makes an attractive specimen. Albite also occurs in grayish-green and brownish colors and both with hornblende. The brownish variety often is coated by iron to a vermillion red, or it may form rough masses heavily coated with brown limonite stains. White, olive-green, and glassy albite are also known, the first two have been found loose while the latter is combined with smoky quartz. Aside from the green varieties, albite in general is so heavily stained by iron oxides that its identity can easily be overlooked. The staining has even penetrated the mineral so that it is difficult at times to expose a fresh surface in order to determine its identity. In general any mineral which shows cleavage and which is stained black, brown, yellow, orange or red is certain to be albite. All varieties, and especially the green, is deeply striated by fine lines. The best place to collect green albite is at No. 1 dump.

The mineral also occurs as the chief constituent forming an albite porphyry (very altered) at the mouth of the upper tunnel.

Amphibole, var. Actinolite:—This is fairly common but good specimens are yet to be found. It occurs in grayish-green crystalline masses of very poor quality and chiefly in altered rocks or with magnetite. It also occurs in small masses and grains in the albite porphyry mentioned above.

Amphibole, var. Amianthus:—Only one specimen has been found so far. See asbestos.

Amphibole, var. Asbestos:—This has been noted in three or four specimens and occurs as small tufts in crevices and as minute veins in hornblende and in mica schist. In one specimen of hornblende, thin slivers of the mineral project out and pass into delicate little fibers of amianthus and these unite to form a much larger vein of coarser fibers of asbestos.

Amphibole, var. Hornblende:—About the most common of minerals at the mine is hornblende. Fine cleavable and coarse crystalline specimens are plentiful and make attractive specimens and especially when combined with green albite. It also occurs with augite, magnetite, pyrite, apatite and quartz. Near the southeast corner of the mine property are two dikes of hornblende. Hornblende in crystalline masses is one of the main constituents of a dark hornblende gneiss (monzonite gneiss) which outcrops at the mouths of the two tunnels and which also is to be found to the right and left of them. The mineral also occurs in small slender greenish crystals on magnetite and on augite, and as slender black crystals in the hornblende itself.

Apatite:—The most common of crystals at the mine are those of apatite, and they occurs from minute specimens up to sizes of an inch or more in length. One specimen was found broken off flush in pyrrhotite whose cross-section was 1-½ inches in diameter and would indicate that large crystals may with search be found. Another crystal found in pyrrhotite was one inch in diameter and two inches long, but its terminations were also missing. The common color is green or shades of green, but brown and grayish crystals also occur. The chief matrix is pyrrhotite and especially the nodular variety but it also occurs in magnetite, quartz and hornblende. Much of the pyrrhotite is so badly weathered that crystals of apatite can be easily extracted. Many of the crystals have their terminations rounded, but they often occur flattened or distorted. The best crystals are found in the nodular variety of pyrrhotite as gemmy, doubly-terminated crystals of a greenish color or even brownish and opaque but whose edges are always

rounded. The writer has broken open dozens of the nodules and in every one of them were apatite crystals and often of fair size. The crystals were generally in the center of the nodules and were evidently the nucleus around which the pyrrhotite formed. In most instances the crystals occur isolated in the nodules, but now and then clusters of them were found and always with the edges rounded as if the crystals had been fused, melted and allowed to run together. The crystals found in hornblende or in quartz were of the grayish-green opaque variety and were of poor quality and with terminations missing. Perhaps such crystals were shattered during mining operations. Apatite also is to be found in crystalline green masses with biotite, and massive with magnetite and pyrite. The mineral is also to be found loose in crystalline whitish masses that appear to be much altered and disintegrated.

Aragonite:—This is found as incrustations on various minerals, chiefly pyrrhotite. One was found coating albite, another Pyrrhotite. It is of poor quality.

Barite:—An interesting find at the mine is barite in amygdaloidal form in an altered rock. Only one specimen unfortunately was found. It contains minute grains of pyrite and is also coated with a very thin bluish crust whose identity has not yet been determined, but is evidently a copper sulphate approaching langite in composition. Amygdaloidal barite is not of common occurrence anywhere, so the find here is of special interest.

Biotite:—This mica is fairly common and occurs as small flakes with hornblende, magnetite, labradorite and even with green apatite. When with hornblende, and especially if it parallels its crystal faces, mica can often be overlooked as both minerals are black. Biotite is also found in small flakes as a constituent of mica schist and in a number of cases the mineral is altered.

Calcite:—This also is a common mineral but good specimens have not been found. It occurs chiefly in tabular form as colorless masses on white granite. It also is found in small crystalline grayish masses and as small grayish crystallized groups both on augite. One interesting specimen found was serpentine (verd-antique) which contained an incrustation of white calcite which in turn was coated with glassy calcite.

Chalcopyrite:—The chief ore of copper present is chalcopyrite and though it is fairly common good specimens are rare. It is generally associated with black hornblende. When it is found tarnished, chalcopyrite makes an attractive specimen for a collection. One specimen of fair quality was also found as a small vein in pink granite.

Copiapite?:—A mineral of common occurrence at the mine is copiapite (?) but its identity has not been firmly established. It may prove to be fibroferrite or even botryogen. It occurs in fairly large amounts in the waste dumps. The mineral is very soft and fragile and where found the surrounding material is likewise soft, almost earthy in form, and the copiapite fills little cavities or pockets in it. The mineral was especially common at the northwest corner of No. 2 dump. It is interesting to note that copiapite is an alteration product of iron minerals and has been formed since the rock was thrown out on the dump, and is therefore less than 100 years in age. This clearly indicates how new minerals are often found at mines which have long since been abandoned and at which they were never known to occur when the mine was in operation. Further, minerals noted when a mine is in operation may, many years later after the mine is abandoned, seem to entirely disappear and can no longer be collected. This may be due to their rarity but more likely in being altered or completely changed or transformed to other minerals, oftentimes breaking down entirely to an earthy mass so that their original form and composition cannot be ascertained? From the earthy mass thus formed, minerals new to the mine make their appearance. Copiapite is only one of many minerals found at the pyrrhotite mine which owes its existence to the decomposition or alteration of other minerals. Melanterite, limonite and selenite are some of the others.

Another mineral associated with the supposed copiapite, and whose identity has not yet been determined, is likewise

soft and fragile but grayish-white in color. It appears to be composed of two minerals, the supposed copiapite just described plus a zeolite (possibly laumontite).

Epidote:—The chief occurrence of this mineral was noted at No. 2 pit where it was found in the fault plane of pink granite. Two specimens were collected (but more were available) in which epidote was polished so highly as to glisten. At No. 1 pit, the mineral in very poor crystals in granite was also found. In the dark hornblende gneiss, specimens of which are plentiful at No. 1 dump, yellowish grains in white quartz are often very common. These grains are epidote.

Goethite:—The rocks and minerals of the mine are heavily coated with hydrated oxides of iron which may range from amorphous limonite to crystalline goethite and even lepidocrocite. It is difficult to identify them with any degree of accuracy unless they occur in distinct forms. Goethite is very common and occurs as minute crystalline coatings and as stains on other minerals. One interesting specimen of pink granite from No. 2 pit has on its polished face (faulted) minute brownish radiating crystals of goethite.

Gypsum, var. Selenite:—The most common of crystallized minerals at the mine is selenite, but it is so fragile and delicate that specimens can only be collected with care. It occurs in clusters or as coatings of minute whitish crystals on rocks, or in pockets in decomposed material. The white granite in the upper tunnel is heavily coated with crystallized selenite. And about 25 feet south of the same tunnel and along the bottom of the bank bordering the path, the mineral is very plentiful and coats decomposed pyrrhotite, limonite and even wood. Some of the selenite here is stained brown by limonite. (see also limonite).

Hematite:—A peculiar mineral at the mine is botryoidal hematite which so resembles psilomelane as to be easily mistaken for it. Other specimens resemble slag because of its cellular structure. It is especially common 70 feet south of the lower tunnel (or 10 feet south of the path) where it is found loose in the soft ground. At the mouth of the upper tunnel it can also be found loose on the ground. It is not an attractive mineral. Hematite is also present as red coatings on magnetite.

Langite:—The best "find" at the mine is langite, a hydrous copper sulphate, which was found September 9th, by Mr.

Looking South over No. 2 dump. A glimpse of No. 3 dump can be seen on extreme left. Lower tunnel is 90 feet South from South edge of dump in center of photo.

Charles Travis. It occurs in minute, well-crystallized, bluish-green prisms in an altered rock, and is associated with at least one other copper mineral, and possibly two, whose identifications have not yet been determined. This is believed to be the first occurrence of the mineral in America, and possibly the second in the world, as it has heretofor been listed from only one locality, Cornwall, England.

Limonite:—About the most common of minerals present is limonite. It appears everywhere, as yellow or brown coatings or stains on pyrrhotite, magnetite, quartz and others and also in a more or less massive form. An interesting occurrence was noted south of the upper tunnel where specimens of a stalactitic nature were found, surrounding fragments of wood (from timber used in the mine many years ago) in which part of the wood was altering to limonite. Small crystallized clusters of selenite were also noted coating the specimens. And at the mouth of the lower tunnel, the water flows over leaves and stems which have become compressed, compacted and are slowly changing into limonite. About 50 feet north from the mouth of the tunnel, interesting specimens of limonited leaves and stems may be collected. Another occurrence was noted about 25 feet west of No. 1 dump where the fine broken up material was cemented together by limonite. It has also been noted that when selenite or aragonite coats a rock or a mineral, limonite coats it first and is in turn coated by selenite or aragonite.

Magnetite:—The mine was originally worked as an iron mine but due to the large amount of apatite and pyrite present which was injurious to iron, it had to be abandoned. Later, on reopening, the pyrrhotite became the ore. Magnetite, is of course, very common on the dumps and especially was it noted in considerable quantities at the northwest corner of No. 2 dump. It can also be seen outcropping at the mouth of the flat, inclined shaft. On the dumps, magnetite is found in large masses weighing many pounds. It is associated with augite and hornblende. A number of specimens collected showed partings, others were beautifully tarnished. One small specimen of lodestone, but very weak, was also found.

Melanterite:—This is the most conspicuous mineral at the mine as it is visible in all directions. It forms thin, white efflorescences, chiefly on pyrrhotite. Many of the rocks on the dumps are much altered or disintegrated, and if blackened and then coated with melanterite the mineral shows up distinctly as thin lines or patches, and is noticeable at some distance. Its alum taste easily identifies it. Due to its softness and friability or even to the unattractiveness of its matrix, specimens of melanterite may not appeal to many.

Oligoclase:—A few massive specimens of this feldspar were collected. It occurs with augite.

Opal, var. Hyalite:—One specimen of pink granite was collected from the fault plane of No. 2 pit in which hyalite was noted. This was of the botryoidal variety and only a small amount was present. A poor specimen coating magnetite was also found.

Orthoclase:—This is one of the constituents of the dark hornblende gneiss seen at the mouths of the two tunnels and elsewhere, and also of the pyroxene diorite which outcrops adjacent to the three shafts. It is generally in small masses or grains.

Pyrite:—Another common mineral is pyrite but good specimens are rare. It is found massive with magnetite, hornblende, and albite. Small cubes of fair quality have been found on calcite and it sometimes is seen as thin films on black hornblende in which, in a number of cases, the pyrite is beautifully tarnished. Very often the mineral is of a yellowish color resembling chalcopyrite and even approaching it in hardness, and is due to weathering.

Pyroxene, var. Augite:—Augite is the only form of pyroxene noted. It too is rather common and often is found in large masses. In fact the largest crystal ever recorded from Peekskill was a

doubly terminated augite from this mine. It is 5x4x2½ inches in size, rough and somewhat altered, weighs 5½ pounds and was found September 9th at No. 1 dump. Augite is associated with hornblende, magnetite and milky quartz.

Pyrrhotite:—Pyrrhotite is the main ore mineral and occurs chiefly in two forms—massive, and nodular. It weathers easily to form melanterite, copiapite and a number of other minerals. The massive variety is the most common, but those specimens found on the dumps weather so easily that a good specimen only with search can be found. Often they are beautifully tarnished and thus make attractive specimens.

The nodular variety is very interesting in view of the apatite crystals which they contain. They are very common and are found chiefly east of the upper tunnel scattered over the ground as rough, brownish, egg-shaped masses. Every nodule broken open yielded apatite crystals.

A peculiar variety of pyrrhotite, whose origin has not been determined, was found September 9, 1932, by Mr. Travis. The mineral is marked off into various shapes, as to resemble tiling, and was at first thought to be a form of crystallization. This view has been rejected. It is the finest of the pyrrhotites to occur here but is, however, very rare.

Quartz, var. Bluish:—As can be imagined, quartz is a very common mineral and occurs in many varieties but in general of poor quality. A bluish variety is about the best grade of quartz present and it is associated chiefly with hornblende. It is not common. One interesting specimen was found associated with apatite, hornblende and magnetite.

Quartz, var. Ferruginous:—Fair specimens of this mineral are frequently seen. One specimen was found containing small ferruginous quartz crystals on magnetite but was of poor quality.

Quartz, var. Greasy:—Only a few specimens of this variety were noticed and they were not very attractive. The mineral also occurs as small grains in hornblende.

The finest apatite crystals occur in pyrrhotite nodules. The nodules are found scattered over the ground as rough egg-shaped masses and are especially plentiful in the area 50-75 feet east of the upper tunnel. The author (left) and Fred Schmeltz (right) examining nodules in the area.

Quartz, var: Iridescent:—Many specimens of quartz, coated with a thin film of iron oxide which is often tarnished, are common, but true iridescent quartz is rare. One or two good specimens of the iridescent variety with hornblende have been found.

Quartz, var. Milky:—Two specimens of this variety of quartz have been found. One was a loose specimen, of fair quality, and evidently was part of a small vein. The other and a better specimen enclosed augite.

Quartz, var. Rock Crystal:—Just one specimen and of poor quality in biotite was found.

Quratz, var. Smoky:—This is about the commonest of the quartz minerals and is associated chiefly with hornblende. One fair specimen was found with hornblende and massive, grayish-green apatite.

Serpentine, var. Verd-Antique:—An interesting mineral is serpentine and a number of specimens were collected at the main dump:

Titanite:—A number of specimens of this interesting mineral were collected. They are all brown in color. One shows wedge-shaped crystals, one inch long, but whose edges are somewhat bruised. Others are cleavable masses associated with hornblende, augite, magnetite, apatite and quartz.

At least ten more minerals are awaiting identification of which two are platy, one black and the other brown; another is an altered biotite; while the most interesting of the lot is a well-crystallized mineral occurring as a thin, white coating (stained brown by iron) on magnetite and whose optical properties coincide with those of microcline. But one would hardly expect to find microcline in this occurrence.

The writer hopes that the minerals just described may prove of some interest to the many readers of ROCKS AND MINERALS and especially to those who have in the past expressed a keen interest in the Anthony's Nose Pyrrhotite Mine. It is surprising what an attraction the mine has for collectors. Even though they have been advised that choice specimens are not to be had, nevertheless they want to visit the locality if for no other purpose than to say to their fellow collectors "I've been there."

It is also hoped that the minerals described may prove of special interest and value to those who plan to be among those present at the mine on July 9th when the National Outing of the Rocks and Minerals Association takes place. The New York Division, with Mr. Fred W. Schmeltz in charge, will hold their outing at the pyrrhotite mine, and it may not be amiss to suggest to those who are beginners that they bring with them some small tin or cardboard boxes in which delicate minerals of melanterite, selenite, copiapite and even limonitited leaves be stored, if such minerals are wanted for their collections.

And if any minerals are found which are not mentioned in this article, the finders would be conferring a favor upon the writer in showing them to him (as he will be present at the outing) or else in writing him at their convenience and describing their finds.

The writer's grateful thanks are extended Mr. Raymond H. Ewell, of Washington, D. C., for identifying many of the minerals found, especially langite; to Mr. Ramon Conover, of Kyserike, N. Y., for the photographs accompanying this article; to Mr. Henry Thurston, of Montrose, N. Y., who, having two copies of Mather's **Geology of New York** was gracious enough to part with one of them; to Mr. Fred W. Schmeltz for obtaining a copy of Beck's **Mineralogy** and for many other helps and encouragements; and especially to Mr. Charles Travis of Peekskill for his warm interest and enthusiasm in the mineralogy of the mine. He has given and is still giving his time and services and use of his car, and the writer owes him many thanks. Without his interest and cooperation this article would never have been possible.

MINERALS OF THE ANTHONY'S NOSE PYRRHOTITE MINE

	Mineral	Variety	Form	Quality	Associated with	Found by	Date
1	Albite	Brownish	Cleavable	Poor	Pyrite	P.Z.	9/ 9/32
		Green	"	Good	Hornblende	"	"
		Grayish-green	"	"	"	"	9/12/32
		Olive-green	"	"	Loose	"	"
		White	Massive	Poor	"	"	9/27/32
		" (Glassy)	"	"	Smoky Quartz	"	"
		"	Phenocrysts	Fair	Altered porphyry	"	9/ 9/32
2	Amphibole	Actinolite	xline masses	Poor	Magnetite; altered rock	"	"
		"	Minute xline	"	Altered porphyry	"	"
		Amianthus (White)	Fibers	Fair	Hornblende	"	9/12/32
		Asbestos (Brown)	"	"	"	"	"
		" (Grayish)	"	"	Mica Schist	"	"
		Hornblende (Black)	Cleavable	Good	Augite; Apatite and Smoky Quartz	"	9/ 9/32
		" (Black)	xline	"	Hornblende Gneiss	"	"
		" "	xled	"	Black Hornblende	"	"
		" (Green)	Minute slender xls	"	Augite, Magnetite	"	"
3	Apatite	Brown	xl	Good	Pyrrhotite	"	9/12/32
		Grayish-green	Gemmy xls	"	Pyrrhotite, Magnetite	C.T.	"
		" "	Group of rounded xls	Fair	Pyrrhotite	P.Z.	9/27/32
		" "	2-in. xl	Poor	"	"	"
		" "	Massive	Fair	Hornblende & Smoky Quartz; Magnetite & Pyrite	"	"
		Grayish	"	"	Hornblende and Augite	"	9/ 9/32
		Green	xline	"	Biotite	"	"
		Whitish	"	"	Loose	"	"
4	Aragonite	Brownish	Coating	Fair	Pyrrhotite	"	"
		White	"	"	Albite	"	9/27/32
5	Barite	White	Amygdaloidal	Good	Altered rock	"	9/ 9/32
6	Biotite		Small sheets	Good	Hornblende & Magnetite	"	"
			"	Fair	Albite	"	"
			"	Good	Apatite (green)	"	"
			Flakes	"	Mica Schist	"	"
		Altered	"	"	" "	"	"
7	Calcite	Colorless	Tabular	Fair	On white granite	"	"
		Grayish	xled	Poor	Augite	"	9/ 9/32
		"	xline	"	"	"	"
		White	Coating	Fair	On Serpentine	"	9/27/32
8	Chalcopyrite		Massive	Good	Hornblende	"	"
			Small vein	Fair	In Pink Granite	"	"
		Tarnished	Massive	Good	Hornblende	"	"
9	Copiapite (?)	Yellow	Loose aggregates	Good	Pockets in dumps	C.T.	9/ 9/32
10	Epidote	Greenish	Massive (polished)	Good	Pink Granite (faulted)	P.Z.	9/27/32
		"	xls	Poor	Granite	"	9/ 9/32
		Yellowish	grains	"	In quartz in Hornblende Gneiss	"	"
11	Goethite	Brown	Radiated coatings	Fair	Pink Granite	"	9/27/32
		"	Stains	"	Bluish Quartz	"	"
12	Gypsum	Selenite	xled	Good	On Pyrrhotite	C.T.	"
		"	"	Poor	On White Granite	"	"
13	Hematite	Gray	Botryoidal	Fair	Loose	P.Z.	9/ 9/32
		Red	Coating	"	Magnetite	"	"
14	Langite	Blue-green	xled prisms	Good	Altered Rock; Hornblende	C.T.	"

	Mineral	Variety	Form	Quality	Associated with	Found by	Date
15	Limonite	Brown	Pseudo leaves	Good	Loose	"	9/12/32
		"	" stems	"	"	"	"
		"	" wood	"	Pyrrhotite	"	"
		"	Amorphous	Fair	Loose	"	"
		Yellow Ocher	Coating	"	Magnetite; Pyrrhotite; Quartz	"	"
16	Magnetite		Massive	Good	Augite, Hornblende	P.Z.	9/ 9/32
		Showing parting	"	"	" "	"	"
		Tarnished	"	Fair	" "	"	"
		Lodestone	"	Poor	Loose	"	"
17	Melanterite	White	Efflorescent	Good	Pyrrhotite	"	"
18	Oligoclase	"	Massive	"	Augite	"	"
19	Opal	Hyalite	Coating	"	Pink Granite	"	9/27/32
		"	"	Poor	Magnetite	"	"
20	Orthoclase		Grains	Fair	Gneiss and Granite	"	"
21	Pyrite		Massive	Fair	Albite and Magnetite	"	9/ 9/32
			"	Good	Hornblende	"	"
		Tarnished	Films	Fair	"	"	"
		Cubes	xled	"	White Calcite	"	"
		"	xls	Poor	Hornblende	"	"
22	Pyroxene	Augite	xline	Good	Hornblende & Magnetite	"	"
		"	"	Fair	Milky Quartz	"	"
		"	Cleavable	Good	Loose	"	"
		"	Large xl	Good	"	"	"
23	Pyrrhotite		Massive	Good	Main ore mineral	"	"
		Tarnished	"	"	" " "	"	"
			Nodules	"	" " "	"	"
24	Quartz	Bluish	Massive	Good	Apatite, Hornblende & Magnetite	"	9/12/32
		Ferruginous	"	Fair	Hornblende	"	"
		"	Small xls	"	Magnetite	"	9/27/32
		Greasy	Grains	"	Hornblende	"	9/12/32
		"	Massive	"	"	"	"
		Iridescent	"	Good	"	"	"
		Milky	"	Fair	Augite and loose	"	"
		Rock Crystal	xls	Poor	Biotite	"	"
		Smoky	Massive	Fair	Apatite and Hornblende	"	9/27/32
25	Serpentine	Verd-Antique	Massive	Good	Loose	"	"
26	Titanite	Brown	xled	"	Augite & Hornblende	"	9/12/32
		"	Cleavable	"	Apatite, Augite, Hornblende, Magnetite & Quartz	"	"

xl—crystal xls—crystals xline—crystalline xled—crystallized

Additional Notes on the Pyrrhotite Mine

Just as the magazine was about to go to press, the writer was advised by a gentleman in Peekskill that the late Mr. E. C. Nation, who was superintendent of the chemical works at Highland (now Manitou), stated that during the World War the mine had been dewatered and a survey made as to the possibility of the copper deposit being sufficiently large as to warrant the operation of the mine. The copper, however, was not found in any of its forms in sufficient quantity and so the project was abandoned.

Mr. Nation also stated that the vein had apparently another outcrop on Iona Island two miles away and diagonally across the Hudson River in the direction of the strike of the vein. Iona Island is now a Government Reservation and permission may be difficult to obtain in order to verify this statement.

Another gentleman informed the writer that he had entered the mine by means of the lower tunnel when the mine was dewatered during the World War. That a flat incline led off the tunnel down to a lower level and off this another incline led down to the bottom of the workings. Thus the mine consists of four levels and cannot be over 300 feet in depth, he believes.

Notes on the Mineral Vermiculite

—*By*—

BEN HUR WILSON

Group — Vermiculites. (844)*
$-H_{24}\,Mg_{12}\,(Al, Fe)_4\,Si_9\,O_{43}$. Xyl.

Var. — Jefferisite. (845)*
$-H_{12}\,Mg_4\,(Al, Fe)_4\,Si_5\,O_{20}$. Xyl.

One of the less common hydrated silicates. For a good physical description consult Dana (Ed. 1904), pg. 476. This very interesting mineral having remained for many years unexploited, is now quite rapidly coming into its own as a commercial product of considerable value. Morphologically, it is known to be the alteration-product of various members of the mica division, to which family it therefore belongs. It possesses a highly complex formula, and due to the exceedingly large quantity of water of crystallization locked up in the molecule presents, when heated, a phenomenon little short of spectacular. The slow opening out of the countless laminae, like the pages of a book, is impressive; small fragments expanding into "long worm-like threads" It was this property from which the group derived its Latin name, "vermiculari", to breed worms. A number of specie names, ten or twelve, have been assigned to various minerals of this group, due to its wide range of occurrance throughout many parts of the United States. There is doubtless much over-lapping with respect to some of these names, the existing nomenclature being in a state of considerable confusion.

The treatment required to convert the natural mineral into a commercial product is quite simple. When expanded by heat, under ideal conditions, its weight is changed from about 90 lbs. per cubic foot, *to 6.25 lbs. per cubic foot; that is the volume is increased nearly fifteen hundred per cent. To one's great astonishment, such is its new weight, that, a two bushel sack of the processed mineral may easily be lifted with one hand. The expanded material will float on water like a cork. During this processing its color changes from a dark, pearly, serpentine green, to a beautiful, lusterous, light bronze, whose sheen when finely pulverized becomes almost metallic. The processing of this mineral is done by the F. E. Schundler Company, specialists in mineral grinding, at their plant in Joliet, Illinois, where Mr. Schundler has developed a new type of furnace especially adapted for this purpose. The calcinated product is reduced to several sizes and reformed, by addition of various binders into many types of heat and sound insulating materials. For these purposes no other known substance possesses superior qualities. Other practical uses are being developed, under the trade name "Zonolite," and "Therm O Flake", for and by the Illinois Clay Products Company.

This company controls an almost inexhaustable deposit of the mineral near Libby, Montana (located on the lines of the Great Northern Railroad, in Lincoln county, in the extreme northwest corner of the State), said to consist of a workable face more than 1500 feet high on the mountain side and at least a half mile long. The entire extent of the deposit at this locality, which exists as an enormous volcanic stock, has never been fully prospected. Most of the central claims are now consolidated under one management although, it is said, there are outlying deposits in the nature of dykes, some of which may prove workable, though at present they are considered rather inaccessable from the standpoint of transportation.

This writer will gladly send, gratis, a small specimen of this interesting mineral, to any who desire it, upon receipt of a self-addressed 3c stamped envelope (Address, Ben H. Wilson, 112 Mississippi Avenue, Joliet, Illinois).

*Number and formula from "Comprehensive List of Minerals", by A. R. Crook.

Geology at A Century of Progress

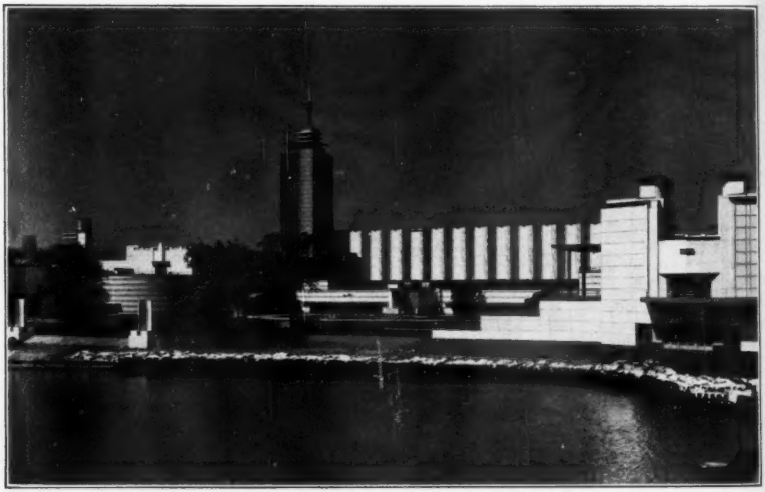
—— *By* ——

G. FREDERICK SHEPHERD

Technical Assistant in Geology, Museum of Science and Industry, Geology Section, A Century of Progress

The exhibits at A Century of Progress may be grouped in three categories: (1) the principles and facts of theoretical science which are the foundation of our century of industrial and social progress; (2) the relationship between scientific discoveries and industrial advancement; and (3) the effect on civilization of the achievements of both science and industry.

Fitting enough, therefore, is it that among the basic sciences which have contributed so much to the progress of our civilization, geology and its network of branch sciences should be one of the keynotes at this Fair. In recognition of the important place that science holds in the world today A Century of Progress has erected the Hall of Science, which houses the exhibits of physics, mathematics, chemistry, geology, biology, and medicine. Astronomy alone is shown elsewhere, in the Adler Planetarium, which is within the exhibit grounds.



Where the magic of modern science will be portrayed this year in Chicago—The Hall of Science of A Century of Progress. This huge structure, 700 by 400 feet, is shaped like a U, and encloses on three sides a court capable of accommodating 80,000 persons. At one corner rises a 176-foot tower equipped with a carillon. The building faces a beautiful lagoon, an island and Lake Michigan beyond. At night it has the appearance of a brilliantly illuminated metal and glass creation, rising from colored terraces. The Hall of Science was dedicated on June 1, 1932. Exactly one year later the science exhibits were officially started by the light of the Star Arcturus, focused by means of a telescope upon a photo-electric cell. Arcturus is forty light years distant, so that the impulse which starts the science exhibits in 1933 left Arcturus in 1893, at the time of Chicago's first World's Fair.

Geology is the science which deals with the history of the earth and its inhabitants. It is concerned with the earth's constitution and structure, with the various stages through which the earth has passed, with the living things which it has nourished, with the agencies which are continually altering it and with the utilization of the earth's materials by man.

"The earth sciences, comprising such fields as geography, cartography, physiography, meteorology, mineralogy, physical, historical, and economic geology, have played an important role in the development of our modern industrialism.

"To cite only a few examples, meteorology has made possible weather forecasting and man's commercial conquest of the air; geography and cartography are responsible for his knowledge of the face of the globe and his varied, planned adaptations to its physical features and climatic zones; and to geology goes much of the credit for making available raw materials upon which our present economic structure is based. One hundred years ago the United States produced no petroleum, practically no lead, zinc or copper, and only insignificant quantities of iron and coal. Indeed so little gold was mined at that time that our total per capita production was only about three cents. Today, owing to great advances in the science of geology and the profession of geological engineering, practically all the mineral resources of the country have become known, and the normal production of most of our raw materials goes on at a rate which is almost incomprehensible.

"The direct social consequences of the geologist's development of the petroleum and other mineral resources of the world are far-reaching and commonplace. But equally important and less well-known is the fact that geology develops an appreciation of the enormous duration of time involved in the gradual evolution of the earth and its inhabitants. It demonstrates the continuity of the past and the present, and furnishes the background for an understanding of man's origin and his present place in nature. Geology also deepens man's esthetic appreciation of scenic wonders through imparting a knowledge of the processes through which the great physical features of the earth have originated. Much of this information is, of course, well-known to the technically trained citizen, but most of the facts have never been fully realized by the, shall we say, 'man in the street'."*

In a prominent introductory space of the Geology Section there is an exhibit embodying the answer to this question, "What is Geology?" It is now necessary to gain the proper perspective so that an appreciation of the functions of geological forces and their results can be had.

For this purpose a giant "Clock of the Ages" is displayed prominently in the Main Hall of the Hall of Science. On a conventional clock dial are marked the major divisions of geological time through which the hour hand passes. A second hand on a smaller dial audibly ticks off the millions of years involved in the origin and development of the earth. Appropriate scenes depicting the life of the past and the appearance of the earth's surface at various stages are automatically projected on a screen and are synchronized with the movement of these hands. In addition, a gong strikes at irregular intervals calling attention to the most outstanding achievements of evolution or to some important event taking place on the earth, such as a period of great glaciation, or extreme volcanic activity. The two thousand million years of recorded geological time are portrayed thus in approximately four minutes and it is significant to note that it is not until the clock is actually "striking the hour of noon" that Man first appears on the scene. With this insignificant attitude the visitor will be in a frame of mind to understand that for instance a river, which, to a human being is always the same, can through eons of time perform such an engineering feat as the carving of the Grand Canyon, or that it can wear back the brink of Niagara Falls many thousands of feet.

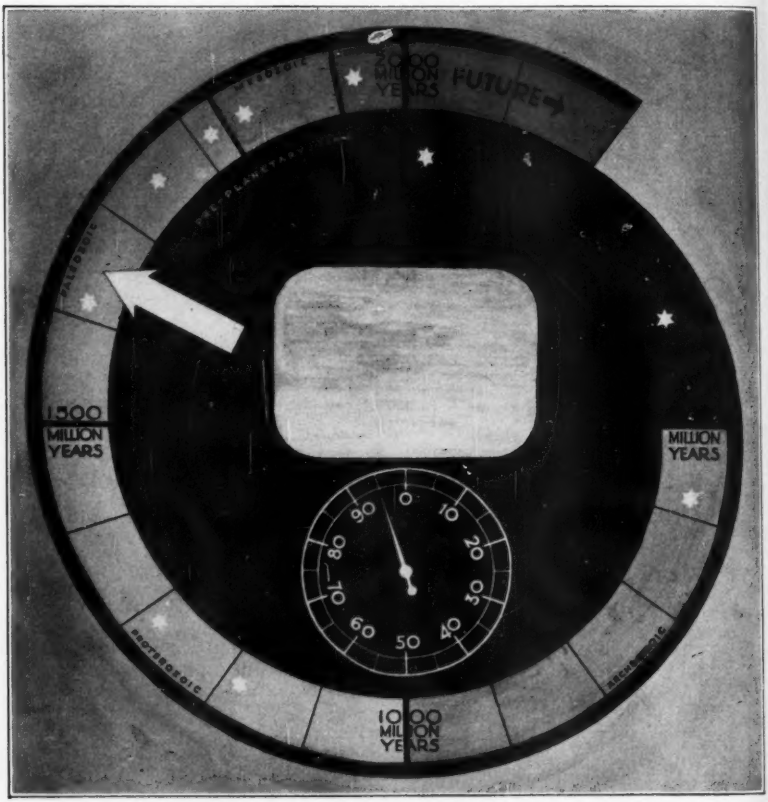
Let us hurriedly go through the Geology Section at the World's Fair and witness the operation of some of the outstanding exhibits. In the first booth we find ourselves seeing how the earth was formed and of what the earth's crust is composed. A large sectioned rotating globe reveals the onion-skin-like structure

*Professor Carey Croneis, "The Earth Sciences at A Century of Progress." *The Scientific Monthly*, April, 1933, pages 380-384.

of the earth. By way of comparison we see also a mural showing Kircher's conception of the interior of the earth in the 17th Century.

In the next booth the activity of ground water is being dramatically demonstrated. The chief exhibit is a 17-foot operating model of the Chicago artesian basin. Right before our eyes we see rain falling on the exposed areas in Wisconsin of the St. Peter and Potsdam sandstones which dip southward towards Chicago, trapping their tremendous supply of water. Thirty million gallons of water a day are used by the industries of the Chicago area alone.

Further on we see examples of the activity of the wind in producing some of our scenic wonders. Looking at the shores of Lake Michigan in the State Dune Park of northern Indiana, we see not only a beautiful scene in this well-known playground, but we can watch an actual dune being artificially created and moving across the front of a giant "blow-out". Adjacent to this exhibit are several fine paintings by the famous dune artist Frank V. Dudley.



CLOCK OF THE AGES
Manufactured by Curtis Lighting, Inc., Chicago.

At the next moment we find ourselves around a large stream table where we see streams flowing to the sea, carving their valleys in a selected clay material and carrying sediments to their deltas just as they do in nature. This stream table is flexible in that by moving a rocker-arm we can make the stream go through its many varied and interesting performances while we wait. The stream may be impounded or waterfalls may be characteristically produced. An operating model of Niagara Falls showing its importance as an index to geological time next attracts our attention. A related exhibit nearby shows the appearance of a submarine canyon off the Atlantic coast which tells us that at one time the ocean bottom was perhaps 2,000 feet above the present land surface and a prehistoric river has carved a canyon like that of the mighty Colorado.

Similar operating exhibits next show us how a volcano performs, how a glacier moves down a valley bringing many thousands of tons of debris and scouring its U-shaped valley. Of special interest to Chicagoans is an exhibit telling the story of the development of the Great Lakes. By means of a special double projector various stages through which the Great Lakes passed since the last ice sheet left this part of the country are shown.

Another interesting exhibit is a machine which demonstrates how mountains are formed. Colored sponge rubber layers are compressed by the pressure box into sharp folds as the rock strata of the earth's crust were squeeezd by titanic forces to produce such mountains as those of the Appalachians or the Alps. In this same section a visitor may merely press a button and watch an earthquake take place and the shock is recorded for him by a miniature seismograph on a slip of paper which he may tear off and take with him as a souvenir.

Space does not permit the description of all of the many interesting exhibits which await your visit to the Fair. Over a dozen fine exhibits of the National Park Service, for instance, depict some of the outstanding scenes in our national parks.

The economic side of geology is in no way neglected in the Geology Section. The origin, occurrence, extraction, and uses of many of our raw materials will be shown by models, dioramas, and other operating exhibits. The American Petroleum Industries have portrayed the petroleum industry by a very elaborate and extraordinary sequence of exhibits. The origin and accumulation of oil, its many modes of occurrence, the manner in which oil is prospected for, and how drilling is carried on, and the labyrinth of systems involved in the transportation and distribution of oil are dynamically and colorfully portrayed.

Words cannot do justice to the many exhibits which have been prepared. You are invited to come and see for yourself.

Mr. Stephen Varni of Stephen Varni Co., New York City, one of our advertisers, addressed the Mining and Geological Society of Lehigh University, Bethlehem, Penna., Thursday evening, March 23rd. The lecture, on gems, and illustrated with lantern slides, was well received by the large number of members and their friends who were present. An exhibit of cut gems, including the famous Varnistar, a crystal cut in the shape of a five-pointed star, whose design has been patented and which bears his name, was an added feature.

Mr. Varni, a gem expert, is a lecturer of note and his services are always in keen demand. He is a gentleman of most pleasing personality, knows his subject well and can present it in an interesting and entertaining manner.

Hobby Values

— By —

EUGENE W. BLANK
Scientific Editor, Rocks and Minerals

I suppose there are many mineral hunters, if I may use the term, who view their mineral collections as mere aggregates of material substances whose cash potentialities are extremely vague. Or more possibly you are one of those myriad numbers who look over their collection, shake their head, and then proceed to tell a friend about the great physical exertion endured in order to obtain some pet specimen. That is all very good. But while you are showing off your "ides" and "ites" there is one idea that will in the great majority of cases never enter your mind. That is, that you are receiving the rudiments of a scientific training and that the study of nature, of which mineral collecting is undoubtedly a branch, is of distinct cultural value. I hope you are not frightened into turning over the page by the word culture. I sincerely hope you are not, yet I find so many people who throw up their hands when they encounter the term, I am afraid the law of averages will hold true in your case. Yet to be cultured does not necessarily imply that one must be high-brow nor must one be the prototype of a bookworm. Culture is merely extension of view and a cheerful philosophic attitude toward life's great problems. It is that subtile, refining change that occurs in a person when he or she comes to realize that life is too precious a gift to be spent seeking the mere material things of this world, altogether heedless of the esthetics of nature.

I hear you murmur that you are not seeking culture, that you collect minerals merely to have an excuse to spend your leisure hours in the great outdoors, trying to retain the cheerfulness and vivacity of youth. That is an admirable aim and I respect any person for it, but unconsciously you are receiving a thorough schooling in the niceties of culture. You cannot avoid them, they come of their own free will and without effort, and what is most significant they are of prime importance. Your minerals you leave at home but the knowledge and intuition you derive from them you carry out into the world and in every contact with mankind it gives color and life to your relations. Nature is never dull, neither is the person who has taken her secrets to heart and professes them.

In what better way can nature be approached than through the study of her handiwork. Rocks and minerals, they are the passports to a glorious realm, a realm of beauty combined with mathematical exactness, of intoxicating joy tinctured with saneness, a country containing works of art which even the most phlegmatic soul must admit are worth enthusing over. Cicero, many and many years ago exclaimed, "Things perfected by nature are better than those finished by art."

Then too there is a vast amount of pleasure in making experiments and discovering a few things for one's self even though one may be merely following in the footsteps of some great scientist. Perhaps we recall the inspired words of G. Galilei:— "Let us remember, please, that the search for the constitution of the world is one of the greatest and noblest problems presented by nature."

For the youth who may some day take up scientific work mineral collecting is possibly the best way for him to utilize his spare time. He will, without being conscious of the change, become skilled and accurate in observation, his power to reason and think in a logical way will be increased, he will develop a critical and impartial judgment and what is probably of prime importance his imagination will be cultivated. The latter is a very necessary adjunct to the scientific mind. As K. Pearson has said, "Disciplined imagination has been at the bottom of all great scientific discoveries."

It is pathetic to note how many people in the rushed progress of life never give a thought to the beauties of nature. It is the steady fall of small drops of water that adorn limestone caverns like fairy

retreats and it is likewise the small beauties of nature absorbed and meditated on from day to day that give to life its sweetest flavor, highest and most exalted meaning. There is no end of trouble in this hectic age. Yet try to take your troubles out under a clear, starry sky. Watch the stately progress of the planets as they swing through the pathless heavens, watch the starry hosts as they marshal and wheel round the boreal pole. Commune with Cassiopeia, the seven Pleiades, with giant Orion.

Wander through the fields and meadows while the soft winds of departing spring scatter the white hawthorn blossoms like drifted snow, inhale the sweet fragrance of the pine clad mountains follow yonder amethystine creek as it meanders through sunkissed meadows where the indian-paint brush, the cowslip gold, the fringed gentian hold forth in rioterious array.

Enjoy the pleasures of the summer, long, languorous days when the earth seems hardly to breathe. Then is mineral collecting at its height and you should rise to the occasion for the days, like life itself, are ever slipping by in joyous abandon.

Go forth in the autumn when nature is all color and tint. The streams wander soft and slow, a golden haze hangs over vale and wood, slowly and majestically the wilted leaves detach themselves from their tenacious hold on life and drift languidly to the earth. It is the fall of the year, the most enamouring of seasons. What emotions it stirs in one!

Daily vast migratory flocks of birds come out of the North and disappear in the South. There is a sense of sadness in the air as though all nature were saying goodbye. Yet in mighty wisdom, she will come again in renewed strength, ever in step with the slow passage of time.

In a word I would have you collect minerals and learn to observe nature at one and the same time. Follow the advice of Bryant who says:—

"Go forth under the open sky, and list
To Nature's teachings."

Man is ever seeking that world where discord and strife are unknown, where all is a harmonious unity. Gladly would he flee there when the poignant sorrows of this world become too multitudinous. It is in just such times of trouble that a hobby serves in its most useful capacity as an alleviation of our troubles, allowing us perchance a glimpse of that ideal world, illimitable and calm, ever serene,

something afar
From the sphere of our sorrow.

There is a saying as true as it is old that an education is never wasted. Friends and money have a way, peculiarly their own, of suddenly vanishing. Then too we can never count on any time but the present, the future is always an enigma to us. So too with minerals, you may lose them but the friendship of the rocks will ever remain your bosom friend and companion. Happily their associations can ever be recalled in an instant. Carry but one secret of nature with you and you will always have something to replace that utter vacuity of soul which drives so many people to desperation.

An old Spanish proverb puts the meaning of all my words in one brief sentence, "The pleasures of the senses pass quickly, those of the heart become sorrows, but those of the mind are ever with us, even to the end of our journey."

If we collect minerals we are very apt to exchange them, creating ripe friendships all over the face of the globe, pulling ever closer the four corners of the earth, until perhaps that day will come when every nation will respect and understand each other. I do not wish to say that mineral collecting and exchanging will bring about world peace, but I do desire to say it promotes it, and I wish to add that what is the most important thing is that Science recognizes neither race nor creed, but her gifts are given freely to all mankind. Goethe in a conversation with a German historian gave birth to the idea that, "Science and art belong to the whole world, and before them vanish the barriers of nationality." These words uttered in 1813 still have a value for us today.

As I have remarked before mineral collecting is good training for the growing boy and girl. It is more than that. Looking back over the days of my youth I find some of my dearest friends and most pleasant memories centering around the pursuance of my hobby. There is nothing so conducive to warming the cockles of ones heart as to take a youngster along on a collecting trip even though I know

(Continued on Page Eighty-seven)

Should Mineralogy be Taught in the Public Schools?

There has always been a question in our minds as to why mineralogy is not taught in the public schools. It is a subject worthy to be classed with Botany, Biology or Zoology, yet for some reason or another no attempt appears to be made to introduce it. True, we have a slight reference to rocks and minerals in Physical Geography, but this reference is practically useless as far as minerals go. Now what advantages could result from teaching mineralogy? Let us point out a few.

1. Mineralogy takes up the structural feature of the earth. It gives an insight to the student of the wonders of the workings of nature as expressed in the mineral world. It will acquaint him with ores, crystals, gem minerals and others that are used commercially, and in which America often leads the world. From rocks he can obtain a general idea of the earth's history, and find that rocks are the oldest substances on the globe.

2. Mineralogy will train a student to observe even minute particles. His eye will be so trained that he can quickly detect objects at which an ordinary person would not even glance. He will see wonders in nature that he heretofor never even thought existed. He will appreciate, too, all that is beautiful or interesting in minerals.

3. Mineralogy will train a student to think. There is something so fascinating about minerals, their color, form or structure, that a student is not satisfied unless he finds out—why?—these colors, forms or structures are present. If he cannot find the answers to these questions in books, he will have to reason them out himself, often with gratifying results. Consequently, he becomes trained to think for himself and may apply this trait to other subjects.

4. It has long been felt that mineralogy would lead to the study of the mineral resources of the various states by young and enthusiastic collectors, who would greatly assist those associated with the State Geological Surveys, in determining and making known the mineral resources of their states. Just as photography owes its great development to the amateur, ROCKS AND MINERALS has been of the opinion that in enlisting the amateur collectors of minerals, the State would greatly profit by the aid they could render in reporting their own discoveries to their State Departments.

5. The collecting of minerals is a great help in the understanding of people of other nations. We find as we study minerals that every country in the world produces some minerals that exceed in form, beauty or rarity those from other countries. A true mineralogist wants these interesting specimens and when he obtains them they are prized highly. There is some mystifying power in possessing such specimens that makes us more friendly towards the country in which they were found. There comes, too, a desire to visit that country and see for ourselves the locality where the specimens were found, and if possible collect a few of them ourselves. Naturally we would look up what we could find about that country, its people and customs. The results may astonish us, when we find now and then that their customs and ideas not only resemble ours but are even superior. Thus many of the suspicions and distrusts that we might have held disappear. Thus mineralogy does much to help in the establishment of that good feeling of hearty fellowship and cooperation among nations that is so sadly needed today.

ROCKS AND MINERALS is heartily in favor of mineralogy being introduced in the curriculum of the public schools. We believe that its study would not only prove of beneficial value and interest to all students but that in its encouragement we would be serving the state and nation.

Mr. Ben H. Wilson, one of our esteemed subscribers and members, and who is a teacher in one of the largest high

schools in the country, in Joliet, Illinois, has sent in a preliminary syllabus relative to the formation and direction of a series of mineralogy clubs for the secondary schools of America.

Theoretically the plan calls for at least three directors working together on a closely coordinated program, who together with the Editor of ROCKS AND MINERALS, the sponsoring organ, and a secretary, would make up the National Board. Each director would be responsible for his particular part of the program and would select and enlist such assistants as would be necessary to lighten and facilitate his work. The directors are to be:

1. Director of Organization and Promotion.
2. Director of Program Building and Research.
3. Director of Publicity and Awards.

The duties of the **Director of Organization and Promotion** would be to promote the organization of clubs and to enlist the cooperation and support of local sponsors for each club, such sponsors being persons who have sufficient training in science and at least an elementary knowledge of mineralogy.

The **Director of Program Building and Research** would cooperate with the local sponsors, in the building of such programs as would stimulate and challenge the interest of the members, and lead them to a thorough knowledge of the subject by a series of uniform, well-organized programs designed to encourage each individual member to take a definite part in the work of the club.

The **Director of Publicity and Awards** would act to secure national publicity for the work, and also grant the awards to be given monthly for the best papers presented before the various clubs, as well as such grand prizes as would be awarded annually to the clubs doing the most outstanding piece of local club work, and making the finest contribution towards the development of the work of the National organization. He would also solicit and obtain from those who would be most likely to benefit financially from such a program, the necessary prizes and awards which could usually take of the form of choice mineral specimens of real value.

The outline of Mr. Wilson's plan is as follows:—

OUTLINE

Preliminary Syllabus, for the organization and direction of Unified Study Club work in Mineralogy, to be undertaken in the Secondary Schools of America, under the auspices of ROCKS AND MINERALS Magazine, Peter Zodac, Editor.

Part I Organization and Promotion.

Organizer

1. Appointment of a National Organizer Director).
   a. Assistants—Local personal aids.
   b. Appointment of State or Regional organizers.

Sponsor

2. Each local club to be sponsored by some adult (preferably a teacher, or some person who has had training in mineralogy or geology).

Membership

3. Club membership need not be confined to students or people of High School age, but may include such adults as are interested in the subject.

Charter and Name

4. Each club upon securing a membership of ten or more may obtain a National Charter from the National Association, and shall be designated by state and letter of the alphabet, in the chronological order of their organization, thus: — National Mineralogy Study Club, New York A.—etc.

Constitution

5. Each club shall adopt a uniform National Club Constitution; and such by-laws as they shall draw up to suit the needs of their own individual club.

Officers

6. Officers of the club shall consist of a President, Vice-President, Secretary, Treasurer, and a Corresponding Secretary whose duties it shall be to report all the "National Program" meetings to the **National Director of Programs and Research,** and to transmit such papers as are to be judged for prizes to the **National Director of Publicity and Awards,** and to report upon the project work of the club for the **Annual Grand Award.**

Meetings

7. Clubs shall hold meetings bi-monthly, for ten months each year,—(twenty meetings). One meeting each month shall be devoted to National Uniform Study Program; and the other meeting to the pursuit of local interests, exchange, identifications, and arrangements of minerals, purchasing of consigned specimens through the sponsor, and to field trips when possible.

Club Project

8. Each club shall adopt and carry out some annual project, tending to direct the attention of the entire community to the work of Mineralogy, which shall be planned by a committee, who shall report their work in detail, through the Corresponding Secretary to **National Director of Publicity and Award** for judging.

Annual Report

9. At the close of the year's work each Club shall make an annual report concerning all of the activities of the Club, together with the list of officers and plans for the ensuing year, and the Club which in the opinion of the National Board shall have been the most outstanding in the excellence of their work, shall receive the **Grand Prize** of the **Rocks and Minerals Association.**

Part II Program and Research

Director—Duties

1. There shall be a **National Director of Program Building and Research,** whose duties it shall be to direct the Study Program work of the various clubs and supervise the selection of and act as consultant in the carrying out of the Annual Project work of the local clubs.

Formal Program

2. He shall arrange an annual uniform study program to be pursued by each club, at the time of their monthly study meeting, and shall cause same to be mimeographed for sending to the secretaries.

Mailing of Programs

3. Upon receipt of the notification of issue of Charter from the National Organizer, the Program Director shall mail out Programs and suggestions for the first and second monthly meetings, and upon reecipt from the local Corresponding Secretary of the report of the first formal program meeting he shall mail out the plans for the third and so on.

Program Outline

4. Upon each formal program there shall be: 1. A paper read upon some mineralogical subject; 2. A paper read by one of the members which he shall have prepared upon a uniform subject, and according to outline furnished by the National Director; and 3. A uniform study hour conducted by the sponsor following the national program.

Monthly Award

5. The prepared paper for each monthly program may be submitted through the Corresponding Secretary to the **National Director of Awards,** who shall cause each paper to be judged for its excellence, and to the writer of the best paper, a prize mineral specimen valued at not less than one dollar shall be sent together with a certificate of award. One such prize shall be granted monthly for each ten clubs or fractions thereof which shall operate under the National Program Plan.

Advancement of Study

6. Directed programs for the same group may continue through three consecutive years of study, as follows:

   1st year—Elementary Mineralogy.

   2nd year—Advanced Mineralogy.

   3rd year—Research Mineralogy.

   One or more study groups may be working under the same club at the same time.

Part III Publicity, Contests and Awards.

Director

1. There shall be a **National Director of Publicity and Awards,** whose duty it shall be to organize the publicity of the Mineralogy Club Movement and supervise the conduct of contests and the making of awards.

Judges

2. He shall appoint competent judges (not less than three) who shall read such papers as are submitted for the granting of awards, and grade them according to such standards and merits

as the director and judges shall agree upon.

Awards

3. The director shall receive the grades and determine to whom the awards shall go, and forward the certificate and the prize awarded to successful member.

Contests

4. In like manner he shall cause to be judged such other contests which shall be designated by the National Board and make the necessary awards.

Prizes

5. He shall cooperate with such companies, houses, individuals, etc., who are most vitally concerned with an increased interest in the subject of Mineralogy, in securing suitable material to be used as prizes in the making of such awards as shall be granted to clubs and members by the National Board.

Publicity

6. He shall direct such newspaper, magazine and other publicity as it is possible to give to the Mineralogy Club work and its results, and thereby stimulate the interest of the individual club members and aid in the growth and development of the whole movement.

ROCKS AND MINERALS

7. He shall in cooperation with the Editor of ROCKS AND MINERALS Magazine arrange for such announcement and printed notes as shall go into this Magazine concerning the work of the National Board and the National Club Work.

In General

1. The directors shall serve without pay.
2. Each club shall pay nominal National dues to help defray the expense of preparing and mailing the outlined program.
3. Each club and as many individual members as possible shall be subscribers of ROCKS AND MINERALS.
4. The club which secures the largest number of subscriptions for ROCKS AND MINERALS for the club year shall receive a special award as a prize, and honorable mention in the magazine.

Respectfully submitted,

BEN H. WILSON,

112 Mississippi Ave.,

Feb. 6, 1933. Joliet, Illinois.

ROCKS AND MINERALS suggests that all those who are in any way interested in forming a club as outlined above take the matter up with Mr. Wilson at their earliest opportunity. We hope and trust that when the fall semester opens up many Mineralogy Study Clubs may open up with them. Which will be the first Club to apply for a Charter?

Hobby Values

(Continued from Page Eighty-three)

that many a frown will be raised at the suggestion. But just try it and you will of necessity be forced to agree that next to finding the best specimen in your collection inducing someone else to join the ranks is about the finest memory to carry through life.

When the younger generation looks upon one as essentially outside its sphere. when friends have answered the great call, when one feels that the number of ones days are fast diminishing a hobby serves it a most useful capacity as giving activity and employment to the mind. Old age of all others offers the consolation that then one will have unlimited time to groom his hobbies and put them through their paces. In the evening of life when all things have assumed a value directly proportional to their true worth hobbies will come into their own. Then it is that they will be at a premium. We need never, I believe, question the value of a hobby. If it brings solace and comfort when all else is gone or turned to dross it has demonstrated its value beyond question or dispute.

The Romance of Portland Stone[1]

—— *By* ——

H. A. J. LAMB

London, England

(*Associate of the Royal Institute of British Architects*)

Due south of Weymouth, picturesquely called the "Naples of England", a rugged hump of land juts out into the sea. Linked to the mainland by a narrow strip, local explanation of this Isle of Portland sounds rather quaint. They say it has become less and less an island as the years have passed. Whilst an ancient inhabitant once emphasized its insularity by declaring that he had never been to England yet and had no intention of going!

America can associate herself with this queerly shaped promontory, likened to the head of some giant bird. Standing amongst a glade of trees is the mansion built by John Penn, grandson of the famous Quaker, William Penn, the founder of Pennsylvania. In this wooded land, the castle named after him, is today a private residence. The grounds are filled with lovely trees, shady bowers and palms. Facing the sea, on a stone flagged terrace, is a circular stone table with hollowed center. Here Penn and his friends deposited the "kitty", when they gambled. In another corner, a sundial stands in the shape of an anchor. The flukes give the time with such amazing accuracy, that a mathematician once spent the day trying to solve the problem of the curves which make this phenomenon possible!

The shades of Penn is still believed to haunt these glades. Dressed as in life with knee breeches, frills and silver buckles. His lean alert figure is supposed to glide silently to the cliffs and with keen eyes gaze across the tumbled waters of the Channel.

To stand on the cliff edge and peer eastwards, where the foreshore is littered with mellowed dark grey stones, is an experience not to be missed. Here Sir Christopher Wren, the ter-centenary of whose birth occurred on October 20th of last year, gleaned the stone with which St. Paul's Cathedral was built and further expressed his genius in fifty other London churches. A jetty still marks the spot where it was shipped direct to the Thames, and amongst the grass lie discarded stones, to this day bearing his special mark—a wine-glass shaped device.

One's mind is carried back to 1675 when he laid the foundation stone of his greatest work. So highly did he value Portland Stone, that 800,000 cubic feet was quarried for his use, and a law was passed through Parliament, at that time giving him exclusive right to it until St Paul's was finished.

The production of stone from the quarries is well nigh inexhaustible, however, but obtaining it is not so easy as it might appear. London is not built of the surface rock, but from a layer of stone often thirty feet and more below. Before this Whitbed, as it is called is reached, the top soil, rubble and dirt bed have to be removed. The last mentioned is usually about a foot thick. Black in colour and very defined. It marks the original ground level of a distant Age. In it are found solidified tree stumps and other forms of vegetable life.

Cap and Roach beds lies below this and are very difficult to remove. Various means are employed for clearing away this obstinate covering before the Whitbed is exposed. Generally dynamite fired by electricity, is employed.

Several firms quarry the stone, the largest owners being the Bath and Portland Firms Ltd. who employ every modern device to save labour and the consequent expense. This latter might be considerably increased were it not for an intervention of Nature. Beneath the Dirt Bed, vertical fissures or gullies have been formed. These curiously enough, all run in a south-westerly direction at fairly regular intervals. Between them, joints occur

[1]Portland Stone is a yellowish-white oolitic building limestone.—Editor.

called by the quarrymen "southers", "easters" or "westers", according to the line they take. Eventually they link up with the gullies and so form a natural series of interlocking blocks. Frequently the joints are clearly visible, but it needs an expert eye to find the most suitable, as very often they have almost closed up. Holes or trenches are worked into these cracks, wedges inserted and hammered home until the rock is forced to spring.

It is fascinating to watch the ease with which the men wield the kivel, or 7-lb. hammer, and the almost human efforts of the grips to tilt a virgin mass of stone to enable them to insert a bar beneath, so that it may split cleanly. The work is arduous and exacting in the extreme, and occasionally during the summer, begins at 4 A. M., so that in the heat of the day it may be suspended.

Payment is made by results, so that the brawny Portlander always hopes that the rock will "start" easily. Twice a day an overseer comes round and measures the excavated blocks, marking in paint the number of cubic feet it contains Sometimes a section too unwieldy for transport is hewn. This has to be split down its natural joints or cut with iron wedges until it is not more than 160 feet cube and equivalent to 10 tons in weight, the maximum size that can be handled conveniently.

The texture of a block from the Whitbed is a lovely sight. Close grained and creamy white when first quarried, the minute shells in its composition gives a character, further enhanced when time

QUARRYNG PORTLAND STONE

A thirty ton block of Whitbed is here seen being cut into three. The Roachbed is immediately above the men bending down.

ROMANCE OF PORTLAND

Ancient Rufus Castle—the oldest building looks down on the backshore where Sir Christopher Wren got the stone for St. Paul's. Path along which it was hauled can still be seen.

tones it to a beautiful silver-grey. The Roach Bed, being more rugged and composed largely of fossilized shells, is harder to work, though well adapted for foundations or sea-walls.

The skilled worker can tell immediately if a block of stone is sound, by striking it and listening to the resonance of the ring, for if it is venty, it will give out a dis-cordant note. An idea of the output of stone, shipped all over the world can be used as a vivid example of its popularity. Mr. H. J. Sanson, the works manager of the firm mentioned, told me that last year they dispatched over a million cubic feet.

In a range of lofty sheds, the stone is worked. In one bay, a screaming dog-tooth and diamond saw cuts like cheese a block of ashlar. In another, a geared blade remains stationary, whilst the stone on its banker moves to and fro beneath a smother of water and a grinding paste of sand and small shot. Intricate machinery carves other blocks into a semblance of the shape required, but much patient human labour has to be expended on carving, which is beyond the scope of mechanical ingenuity.

London owes a lot to Portland stone which seems capable of resisting its polluted atmosphere to a remarkable extent A great many of her historical buildings are built of it. Apart from this, innumerable British War Cemeteries and Memorials will we hope remain imperishable, not the least being the Cenotaph in Whitehall, which is always made an object of pilgrimage, for its silent message forms another link between England and her gallant Ally across the Atlantic.

N. J. Busby, Jr., 35 Renwick Road, Melrose Highlands, Mass., will be pleased to send to every member of the Association a free specimen of Roxbury pudding-stone or one of granite which shows earlier presence of slate if 10c as postage and cost of wrapping is sent him for one specimen or 13c if both are wanted.

The Gem Department

Conducted by GILBERT HART

RESEARCH REPORTS ON PRECIOUS STONES

—— *By* ——

GEORGE O. WILD

Institute of Precious Stone Research, Idar, Germany

Zircon

Investigations into the cause of colors of precious stones which have been conducted in this laboratory for many years have met with success with some stones but progressed very little with others. Such a simple stone as Amethyst still presents unsurmountable obstacles and the sensitive spectroscopic method has brought only negative results which allowed to eliminate certain previous theories but which hardly permit even a guess which substance or element produces the color. The Zircon is another precious stone about which nothing is known relative to the pigment. It was thought that the red to brownish-red Hyacinth would owe its color to chromium but there exists no chemical analysis to substantiate this belief. True, certain elements were found to be present within the molecules of certain Zircons, i. e. thorium, cerium. and yttrium, but to none of them could be ascribed any pigmenting properties. The absorption spectrum of the various precious Zircons is not yet measured and when the new, blue variety appeared on the market several years ago the confusion was complete. It had been stated that the blue color was not natural but was obtained by subjecting the red to brown material to heat and certain chemical agents. Experiments conducted in this laboratory revealed that the blue color is in fact to be derived by giving certain stones a complicated heat treatment and it therefore appears that all blue stones on the market were thus artifically made.

In the course of our investigations we found it imperative to obtain an emission spectrum of at least a few chief kinds of Zircons. The obstacles in arriving at the desired goal were great but they have at last been surmounted. In photographing the emission spectrum, chips of material are brought into the flame of an electric carbon arc and therein evaporated. The glowing vapors emit the lines of the component elements and these lines are fixed on a photographic plate in the usual manner. The technique of the entire work is too complicated to be related here in detail, only so much may be said that the various lines, representing wavelengths of visible and non-visible, ultraviolet light have to be measured and calculated one by one to obtain unquestionable results. Nearly up to one thousand lines had to be measured to obtain the spectra referred to below and this task was almost made impossible by the fact that the Zircon lines show a tendency to produce very broad images of the slit of the spectroscope. In this way adjacent lines are hard to separate and what is most important, hard to tell from the Zircon lines. It had seemed at first that a number of rare elements were present within the stone, however, considering all facts known about the spectral lines of these various elements, their intensities, structure and exact wavelength

it was found that all lines belonged to the element zircon and that there were no foreign additions, no chromium and most singular, that there existed no difference between the spectra of the white the brown, the red, and the blue varieties. Placed one upon the other the spectra differed in nothing from each other; there are as many lines in one as in the other spectra, the intensities were the same and no line was found in one that was not represented in all other spectra.

It was thus shown that the color of Zircon is not due to any foreign metallic pigment as is the case with Ruby, Emerald, precious Topaz, and many other stones, but that it is probably furnished by the zircon atom itself. The sensitiveness of the colors of all Zircons toward light speaks for this assumption. Every collector will know that white Zircon derived from reddish material by heating up to 500 degrees centigrade will turn brownish within a few hours when exposed to even subdued daylight and that brown Zircon will flash in bright red and orange colors after being heated slightly over a bunsen flame but will reverse into the original dull brown after a short time even in the dark. The instability of some of the blue Zircons, named "Starlites" by the late Dr. Kunz of the firm of Tiffany & Co. is a source of constant trouble for many jewelers.

The result of these preliminary investigations is therefore that it has been definitely found that chromium is not the pigment of the red to brown Zircon though some varieties of the mineral may contain the element and that there seems to exist no secondary body within the molecular structure which produces the color.

BOHEMIAN GARNETS

—By—

CHARLES R. TOOTHAKER

For a great many years, Bohemia has been one of the important regions from which gem garnets have been obtained Travelling through that region in the summer of 1932, I visited a couple of localities in order to see how and where the raw material is found.

I was quite surprised when I learned the real facts connected with this old and still reasonably important industry. These garnets are and always have been found in alluvial deposits. There are three localities, only two of which are producing to any extent now, these two being Trebenice and Podcedice. Both are in northern Bohemia, a few miles south of Teplice.

The first of the two localities, Trebenice, is the one I examed as closely as I could. I found a little hotel, or as they say, a **hostinec,** at a place where there were perhaps eight or ten small houses At the side of the hotel which, by the way, was a very small place indeed with not more than five or six rooms at the most, was a pile of gravel which they told me was the material from which the garnets had been taken. Then they showed me a stream of water less than six inches in width where they said the gravel had been washed and in which remains of some little dams were still visible. Had the dams been in good condition they would have formed pools three or four feet across and as much as three or four inches deep. In these pools and using common tin basins, the gravels had been washed. The garnets, being heavy were rather easily separated from the worthless and lighter material.

I wanted to see where the gravels were found but was told it was not possible to see that at this time of the year (July) because the bed of the gravel was out in a field where crops were then being raised. It seems that there is an area three or four kilometers in length and approximately one kilometer in width where the proper gravel occurs underneath the top soil. This gravel is not found at a greater depth than five or six feet at the most.

Anywhere in that area a peasant is likely to dig garnets when the ground is not frozen and when crops are not being raised. His interest in digging garnets is influenced by the price at which they are selling and his knowledge as to whe-

ther that immediate locality, or that particular field has been thoroughly dug over in the past.

Most of the digging is done in the early fall and gravel is taken from small pits. These pits are then filled up and the top soil replaced so that crops may be produced in the following spring. Sometimes water is pumped from a little distance but usually the gravel is taken to some nearby stream.

The clean garnets are sifted into two or sometimes three sizes. The largest size can be cut into small gems and the peasant sells it in "lots", it being clearly understood that a lot is what will weigh about 16 grams. The gems that can be cut from these stones are only the small-sized garnets which one sees in clusters of Bohemian garnet jewelry. Occasionally there is a larger garnet pebble suitable for making a scarf pin or a center of a cluster. Such large stones are picked out and sold individually.

The garnets of the second size are too small for any real use in gem cutting but are said to be very extensively used for jewels in watches—(every lot of the first-sized garnets must be accompanied by half a kilogram of the second-sized material). Sometimes this second-sized material is further sifted so that very fine stuff is removed from it and no one at the locality seemed to know what use could be made of that fine garnet, although some seemed to think it was used in abrasive powders.

Everyone says that all of the garnet-bearing area has been pretty thoroughly dug over and that in a very few years they think that the whole region will be entirely exhausted.

Apparently no large garnets have ever been found in Bohemia. Nearly all of the jewelry which is sold consists of a central stone which is commonly a garnet from India, surrounded by smaller stones actually from Bohemia.

The rough stones are purchased by dealers who go around the country and buy either directly from the peasant or from some local dealer. Then the stones go to Turnov to be cut.

Here again the industry is seasonal There are cutting establishments at Turnov that handle the raw stones and sell the cut stones, but when I visited the city and asked to see the cutting operations, I was told that none of that work was done in the summer. When the peasants of the neighborhood can no longer work in the fields, they are busy cutting gems at home. A peasant will get a certain number of rough garnets of a certain size from one of these cutting establishments and will take the stones home with him During the winter he will cut and polish them and then take the finished gems back to the firm from which he got the raw material, receiving pay for his labor. Practically all of the Bohemian garnets that the world has ever seen have been produced and have been cut in the manner described.

So far as I was able to learn, no one knows the sources from which these gravels were originally derived, and no one has found any of these garnets in their original bedrock.

DIAMOND

E. F. G.

Who shall with scientific certitude
  Declare the diamond's miracle aright!
Fairest of gems, brilliant and many-hued,
  Dispersing light as arrow in swift flight!

Yet formed uniquely simple, the one stone
  Of price, that of a single element,
Carbon, so common amongst Earth's stuffs, alone
  From out enormous heat and pressure's rent.

Of hardness—not a substance known to man
  Can equal it—and yet withal, quite brittle,
With four-way cleavage, teaching artisan
  To split its bulk at barest tap of metal.

Acid proof, defiant of mere flame,
  Still, when with air of oxygen to aid,
A taper, shedding soft beams in Jesus' name,
  Burns not more evenly until it fade.

Of eld they bade the April-born to wear
  This lustrous, clear, transparency
For stilling storms, preserving peace, and e'er
  To foster innocence and purity.

Adamas (unconquerable)—happily thus styled—
No other, thou, than Mineral's fav'rite child!

(Writeen for ROCKS AND MINERALS.)

Mineral Postmarks

—*By*—

ALVAN BARRUS

Lithia, Mass.

Mineral collectors are fortunate in having a hobby that is interesting to the general public. A collector's first duty is, of course, to himself. He should collect what he wishes, in a way most pleasing to his own tastes. But if he desires to show his collection to his friends, including non-collectors, and derive pleasure from their exclamations of wonder and praise, he will endeavor to create little touches which will catch the untrained eye and hold its attention by setting off the collection as being more than a heap of rocks.

One of these touches which lends uniqueness is obtainable by using Mineral Postmarks, a partial list of which follows. My interest in this sideline was aroused upon learning that our local Post Office, LITHIA, was so named because large quantities of spodumene, containing about six per cent lithia, were found nearby. An investigation of the Postal Guide showed other Post Offices, many hundreds of them, which were named after minerals. A complete list would be bulky and uninteresting. For example there are more than seventy Post Offices named after the mineral SILVER. Realizing this, the list which follows was selected as representative and including all the important names. Some are included which are not strictly mineral names, but which are unusual and amusing, such as ICE, Kentucky, MUD, Texas. FRESH AIR, Wisconsin. Combination names like Goldfield and Silver City have been avoided because of their great number.

If you desire to make a collection of postmarks write to the Postmasters of the Post Offices from which you want marks, enclosing a self-addressed, stamped envelope, stating that you would appreciate a clear postmark on it. My experience has been that Postmasters are very obliging in providing clear postmarks to those requesting them. If you do not care to spend six cents plus cost of stationery for each postmark, you can obtain from your Post Office postal cards with reply card attached. If you send these for your post-marks the total cost will be but two cents each.

When you receive your postmarks you have a choice of saving the entire envelopes and cards, or cutting out the cancellations to suit yourself. Also you have a choice of mounting them in an album, or placing them among your minerals. Another scheme would be to obtain specimens from the locality named on the postmark. This would call for considerable work, but what could be more unique than a mineral collection using postmarks as name and locality labels!

If these names are not enough for you, go to your Post Office and consult the latest Postal Guide. In it you will find names of Mineral Post Offices to your heart's content.

This list is not complete. No attempt was made to list all the states in which Post Offices of the same name occur. An effort was made, however, to see that each state was represented.

Postage to Alaska is the same as that in the United States.

Agate—Colo., Ga., Mich., Nebr., N. D.
Alabaster—Mich.
Alum—Ark.
Amber—Iowa, N. Y., Okla., Wash.
Antimony—Utah
Asphalt—Ky.
Asbestos—Md.
Barium Springs—N. C.
Basalt—Colo., Idaho
Beryl—Utah, W. Va.
Bole—Mont.
Boulder—Colo., Ill., Mont., Utah, Wyo.
Calamine—Ark., Wisc.
Calcium—N. Y., Pa.
Carbon—Ind., Iowa, Okla., Texas, W. Va.
Carnelian Bay—Calif.
Chalk—Texas
Chloride—Ariz., Mo., N. Mex.

Chrome—Colo.
Clay—Calif., N. Y., Texas
Coal—Mo.
Cobalt—Conn.
Coke—Va.
Copper—Calif.
Crystal—N. H., N. D., Okla., Ore.
Cuprum—Idaho
Deposit—N. Y.
Diamond—Alaska, Ga., Pa., Wash.
Diorite—Mich.
Dolomite—Ala.
Emerald—Nebr., Pa., Wisc.
Emery—Ark., S. D., Utah
Epsom—N. H.
Fossil—Ore., Wyo.
Fresh Air—Wisc.
Fresh Water—Calif.
Galena—Alaska, Ill., Kans., Mo., Ore.
Garnet—Calif., Mich., N. Y.
Gas—Kans.
Gem — Idaho, Kans., N. C., Texas, W.Va.
Gneiss—N. C.
Gold—Pa., Texas
Gold Dust—La.
Granite—N. H., Okla., Ore.
Greenstone—Pa.
Grindstone—Maine, N. Y., Pa., S. D.
Grit—Ky., Texas
Gypsum—Colo., Kans., Ohio
Hematite—Ky., Mo., Va.
Hiddenite—N. C.
Hornsilver—Nev.
Ice—Ky.
Iron—Minn.
Jasper—Ore.
Jet—Okla.
Kaolin—Nev.
Lead (pronounced leed)—S. D. (not the home of a lead mine)
Lead Mine—Mo., W. Va.
Leadore—Idaho
Leadville—Colo.
Lime—Colo.
Limestone—N. Y.
Lithia—Mass.
Lithium—Mo.
Marble—Ark., Pa., Wash.
Mercury—Texas
Mica—N. C.
Miner—Mont., Wisc.
Mineral—Ark., Calif., Ill., Ind., Kans.
Mines—Pa.
Mud—Texas, W. Va.
Natron—Ore.
Nickel—La.
Nickel Mines—Pa.
Nugget—Ore.
Obsidian—Idaho
Oil—Ky.
Oolite—Ky.
Onyx—Ark., Calif.
Opal—Ark., Fla., S. D.
Ore Bank—Va.
Outcrop—Pa.
Pebble Beach—Calif.
Petroleum—Ind., Ky., Texas, W. Va.
Platina—Calif.
Potash—La.
Pretty Rock—N. D.
Pyrites—N. Y.
Quarry—Va., Wisc.
Quartz—Calif., Ga.
Quicksand—Ky.
Radium—Colo., Kans., Minn., Va.
Rain—Ky.
Rock—Kans., La.
Rocks—Md.
Ruby—Alaska, Ariz., La., N. Y., S. C., Va., Wash.
Saltpetre—W. Va.
Saltville—Va.
Sands—Mich.
Sandstone—Minn., W. Va.
Sapphire—N. C.
Shale—Va.
Silica—Kans., W. Va.
Silver—Ark., Texas
Silvermine—Mo.
Silt—Colo.
Snow—Ky., N. D., Okla.
Slate—W. Va.
Slatington—Pa.
Sod—W. Va.
Soda—Texas
Soapstone—La.
Stibnite—Idaho
Stone—Idaho, Ky.
Strata—Ala.
Sulphur—Ind., Ky., La., Nev., Okla., S. D.
Telluride—Colo.
Talcum—Ky.
Talking Rock—Ga.
Topaz—Calif., Mo., Mich.
Trona—Calif.
Tungsten—Colo.
Urania—La.
Vanadium—Colo., N. Mex.
Volcano—Calif.
Whetstone—Ky.
Zinc—Ark.
Zirconia—N. C.

Editor's Note:—This article was specially requested of Mr. Barrus as a pleasant surprise for those of our readers who are not only mineral collectors but stamp collectors as well. It is hoped an interest in postmarks may result and that many may start a collection of them

Field Museum Notes and News Items

Contributed by

THE FIELD MUSEUM OF NATURAL HISTORY
Chicago, Ill.

Two specimens of a meteorite from a "meteor crater" at Odessa, Texas, have been presented to the museum by Dr C. T. Elvey of the Yerkes Observatory, Williams Bay, Wisc., it was recently announced. They will be added to the museum's collection of meteorites which in point of number of falls represented, is the world's largest collection. The new specimens are of special interest, states Dr. Oliver C. Farrington, curator of geology and noted authority on meteorites, because they are the first the museum has acquired from a "meteor crater" other than the well-known one at Canyon Diablo, Arizona.

A rare specimen of the curious and mysterious rock formation known as a geode, important because it is one of the largest ever found, has been presented the museum by William J. Chalmers, of Chicago. It is now on exhibition in the large and famous Chalmers crystal collection in the department of geology. Geodes are hollow balls of rock which, in their most interesting form, have interiors lined with brilliant crystals. They vary in size from about that of a pea to, in rare instances, nearly two feet in diameter. The specimen just presented by Mr. Chalmers is 22 inches in diameter weighs about 125 pounds, and its interior is lined with quartz crystals of unusual brilliance. It was found near Hamilton, Illinois.

Geodes are characteristic of certain geological formations, particularly in strata of Lower Carboniferous or Mississippian age, according to Dr. Oliver C Farrington, curator of geology. One of the most important areas producing them is in two counties bordering the Mississippi River—Lee County in Iowa and Hancock County in Illinois, Dr. Farrington says. No answer generally satisfactory to geologists as to the cause of the formation of these natural balls with their crystals has yet been propounded he states. One theory is that they are deposits, made by infiltration of water in spaces from which water or other agents have previously removed fossils. This explanation, however, is imperfect because goedes occur in many areas where there are no evidences of the existence of fossils which could have been their source.

The new specimen at the museum has been broken open in such a way as to reveal the beautiful crystal lining of its interior.

"The Geological History and Evolution of the Horse" is the title of a booklet, written in popular style for the lay reader, published recently by the museum. Elmer S. Riggs, associate curator of paleontology, is the author. The text, in some 50-odd pages, traces the development of the horse from the earliest known species, **Eohippus,** which was about the size of a housecat and lived about 50,000,000 years ago, down to the horses of today. It is copiously illustrated with nineteen photogravure plates of fossils, parts of fossils, anatomical features, restorations of various species of prehistoric horses, and pictures of certain modern species; and also contains four drawings illustrating points about the evolution of the horse. The book is printed by Field Museum Press.

The changes in the various succeeding species through the ages, beginning with four-toed horses, and coming through stages where each foot had three toes down to the modern one-toed or hoofed animal, and the other concurrent anatomical developments occurring during

the millions of years of evolution, accompanied by a steady increase in size, are carefully traced by the writer. In his introduction, Mr. Riggs states:

"The horse family furnishes one of the best known examples of evolution This is due to two important factors: First, the horse has, during his history, undergone great changes both in size and structure; second, the records have been so well preserved that almost every important chapter in the family history, during a period of millions of years, is known and recorded. This makes possible a detailed study of the evolution of this animal."

Columns of Welsh slate, perfectly cleaved into uniform sheets one-eighth and one sixteenth of an inch thick by skilled quarrymen, are exhibited in the Clarence Buckingham Hall at the Mu seum.

How old is the earth and how may one know its age?

An analysis of the principal methods which have been applied to the solution of this problem, and the results obtained is presented in an article in the April issue of **Field Museums News,** monthly bulletin published for the several thousand members of the Museum. Sharat K. Roy, assistant curator of invertebrate paleontology, is the author.

All that can be stated definitely from the data thus far produced by study of the most reliable indicator known, is that the earth's age at least far exceeds 1,460,000,000 years (one billion four hundred sixty million), Mr. Roy concludes. This is computated on the results of studies made of the lead ratios in radio-active minerals.

A collection of rare elemental gases of the argon family, shown glowing with the bright colors they radiate when excited by a suitable electric current, has been placed on exhibition in the department of geology at the museum. Normally these gases—neon, argon, helium krypton and xenon (all of which occur in minute quantities, as component parts of the air)—are colorless and invisible, yet it is through them that brilliant colored lighting displays for signs and other purposes are now obtained. Various other uses are also being made of them in modern industry.

Argon, in addition to providing a blue color for luminous signs, is of great importance for filling incandescent lamp bulbs, the light of which it improves, as well as increasing their life and economy It is the most abundant of the rare gases one part being present in 125 parts of air, according to Henry W. Nichols, associate curator of geology.

Helium provides a yellow light for luminous signs, but is most important for inflating balloons because of its lightness of weight combined with the safety obtained through its non-inflammability. One part helium is found in 250,000 parts air.

Neon provides the red glow in luminous signs, and is used also in signal lights, in lights for television receivers, and lights for visual tuning of radio receivers. One part neon occurs in 80,000 parts air. Krypton is present in air only to the extent of one part in 2,000,000, while xenon occurs in the almost infinitesimal quantity of one part in 17,000,000 parts air. The exhibit is a gift to the museum from the Air Reduction Sales Company of Chicago.

Laterite, a curious substance which sometimes occurs in place of soil in tropical and subtropical regions, has been added to the geological exhibits at the museum. It is occasionally found as far north as the southern borders of this country.

Graphic illustrations of the quantities existing in the crust of the earth of certain elements is afforded by globes added to some of the geological exhibits at the museum. The globes give an idea of the amount of the elements as compared with the extent of the continents and seas.

Aluminum is shown to be the most abundant of all metals, and iron the second most abundant. This, it is pointed out, takes into consideration only the iron in the actual crust of the earth to a depth of ten miles, which is the farthest point accessible. There is reason to believe that the inaccessible interior of the earth contains vastly larger quantities, probably as much as two-thirds of the entire substance of the earth being iron, states Henry W. Nichols, assistant curator of geology. Of non-metallic substances, with the exception of oxygen, silicon is shown to be the most abundant as an ingredient of the earth's crust.

The Amateur Lapidary

Conducted by

J. H. HOWARD*
504 Crescent Ave., Greenville, S. C.

Amateur and professional lapidaries are cordially invited to submit contributions and so make this department of interest to all.

*Author of—*The Working of Semi-Precious Stones.* A practical guide-book written in untechnical language for those who desire to cut and polish semi-precious stones.

CONDITION AND USE OF TIN LAP

Those of us who have been cutting faceted stones have learned that the difficulty of polishing a facet varies directly as some considerable power of the area of the facet. We have probably learned that almost from the start we had no trouble with scratches on the small facets but that the tables of brilliants were likely to prove nightmares. For a long time this was my often repeated experience. Then after an especially trying experience with some tables I abandoned "production" and went into pure research.

Using a smooth lap and liberal applications of tin oxide paste, I had been getting very good results on the small facets. This led me to believe that my system was right but that there was some minor "kink" that I had not learned. The result of the experiments was very gratifying. I became able to consistently get perfect polish on the tables of reasonable sized brilliants. I was still, however, striving for a perfectly smooth lap and believing that the nearer the lap approached smoothness the more readily could I get perfect polish.

About this time Mr. C. B. Hamilton of Norway, Maine, was kind enough to remark that "a perfectly smooth lap will not polish a gem". Mr. Hamilton then gave description of how to condition the tin lap for a minimum of trouble with scratching. Apparently if the tin lap is smooth, the polishing powder and the cut away material of the gem will roll into grains that, being unable to get from under the facet will cut a furrow in the gem. Combining the instructions of Mr. Hamilton with my own findings I submit the following as helpful in attaining perfectly polished facets.

Be sure there are no particles of gem material, grains of carborundum or other foreign matter is adhering to or embedded in the face of the lap. This may be fairly safely accomplished by scraping the surface of the lap with a razor blade while the lap is running. With the corner of a razor blade make a series of radial cuts in the face of the lap, extending from the center to the periphery at which point they should be about one quarter inch apart. Do not use a thick knife blade for the cutting. Put the lap on the spindle, daub it with a heavy paste of tin oxide and proceed to polish the lap with a large flat piece of quartz or agate with rounded edges, keeping the lap wet. Continue this for several minutes to partially smooth down and level the ridges raised by the blade in its cut. Then apply a rather light coating of the oxide paste and let it become dry. Continue the polishing with the lap dry, using rather heavy pressure. This operation will quickly put a bright polish on small irregular areas along the tops of the ridges. The area in between the ridges will remain dark. They constitute "gulleys" into which the polishing material and the cut away gem material may fall and collect harmlessly. The lap is now ready for use.

In using it the principle precaution to be observed is to not apply the paste too

thickly. A tablespoonful of dry tin oxide in water three quarter inch deep in a vessel two and one half inches in diameter will give about the right consistency if kept well stirred. Proceed, with the lap wet with the above mix, to polish the facet until all traces of the carborundum cut have disappeared. If the facet is a large one it may be very much grooved at this stage. Now apply a charge of the thin paste and allow it to become entirely dry. Then proceed to put on the real polish on this dry lap, with a firm pressure and working for very short periods as the stone will heat rapidly.

A DIRECTORY?

A good friend of this department, Arthur Knapp, Philadelphia, has a suggestion on which we would like to get opinions. For months Mr. Knapp worked alone at faceting (we dare say alternately sweating and swearing tho he has not authorized the publication of this detail) only to learn that all about him were men with the same troubles and with whom he might have been exchanging ideas to the benefit of all parties. His thought is: why not give an opportunity for active cutters and gem collectors to register in a directory maintained by this department? Then each man may know who of his neighbors are interested and to what extent and in what specialty. In that way many burdens may be lightened and many delightful friendships established.

If you are an active amateur lapidary and this ideal appeals to you send us the dope on yourself **now.** A postcard will do. Give name, address, specialty (gem cutter or collector), if a cutter whether doing cabochons or faceted gems or both, experience (beginner or advanced student or professional.)[1]

We would be delighted to have professionals register as willing to help their neighbors.

If the response justifies the step we will establish this directory but please understand that for this list we want only the men who are actively engaged in cutting or collecting. The list is not to include the many who are interested but not actively working or studying the subject.

[1]Address all cards to the conductor, J. H. Howard, 504 Crescent Ave., Greenville, S. C.

MATERIALS FOR CABOCHONS

A question that seems to bother the beginner is the one of what materials to cut. I have consistently recommended agate as an excellent subject. And continue to do so. But natural agate is not available in a wide range of vivid colors and some bright colors are needed to brighten up your trays. I have cabochons grouped by kinds in several trays. I have one of agate only. One of opal and turquoise, etc. But the brightest and most attractive tray I have and the one that attracts the most attention carries several of each of the following stones in varying shapes and sizes: Transparent green fluorite, Amethyst, Fire opal, Red and black variegated obsidian, Azurite, Rutilated quartz, Carnelian, Red jasper, Chrysoprase, Chrysocolla, Garnet, Tiger eye, Thomsonite, Blood stone, Blue chalcedony, Azur-malachite, Malachite, Rose quartz, Blue turquoise and Green turquoise.

In short have one tray to carry specimens of every vividly colored gem you have in your collection.

A reader in Ann Arbor, Mich., wrote the conductor of this department about a certain phase of lapidary work. The reply has been returned to the writer as undelivered. The signature was not very legible. We would appreciate it if the writer of the letter would again write us giving name and full address.

The Needles, California Division, J. C. McCorkle, Director, which held its outing on April 9th, due to the very hot weather which prevails there during the summer months, was a grand success even though only twelve participated. Because the March issue of ROCKS AND MINERALS was almost four weeks overdue, members had only about five days to arrange for the outing, otherwise a larger group would have been present. Further details will appear in the September issue.

American Pathfinders

— *By* —

WILLIAM C. McKINLEY

730-B—4th Ave., Peoria, Illinois.

FREMONT

How many Junior Collectors have ever given a thought to "why" explorers are explorers, and "why" pioneers are pioneers—and, above all, "why" collectors are collectors? There's only one good reason, and that is, they all have within them that roving nature that makes us want to be "going places"! It has been this undeniable yearning, for the outdoors, that has prompted our famous explorers to become what they have, by giving vent to their feelings, and seeking the open road!

John Fremont, who is known in history as the Pathfinder of the West, had that great roving nature, so important to all nature-workers. As the Conqueror of California, he gained recognition to the highest degree—but, besides this, in his life-time, he was a senator, major-general, governor, and even a candidate for President of our United States. What a list of accomplishments for one man!

Fremont made five exciting expeditions into the far West, which at that time was composed of vast barren stretches, and high, rugged mountains, with Indians supposed to be hiding behind each sage-bush, and each jagged boulder! The Land of Mystery it was nicknamed! But our great pathfinder, through numerous hardships, marked the courses and made maps, which in later years aided the great immigration over the Rockies, seeking either for gold in California, or homesteads in Oregon. Fremont was the first to scientifically explore, and record in literature, and on maps, the mountains of the West, the roads and trails over them, and, the descriptions of the people

there, vegetation, and many other needed news, besides, **collecting** many fine specimens of scientific value.

John Fremont was born, 1813, in Savannah, Georgia, and though of a studious mode of mind, the routine of classes made his restless soul wander to nature. He loved the outdoors. And when, after reaching manhood, as an explorer, he studied both as a scientist, and as an adventurer. This should be a good hint to Junior Collectors—your ambitious collecting around your own locality now may prepare you for some future outdoor feat, much more important, yet to come!

As an assistant engineer, under the famous Frenchman, Niccolet, Fremont surveyed the sources of the great Mississippi. After returning from this trip Senator Benton, of Missouri, became attracted to him, and, through his influence with President Harrison, Fremont was chosen to explore the South Pass "in aid of and auxiliary to the Oregon emigration". It was also the daughter of this Senator Benton, to whom Fremont wooed, and won the hand—to become Mrs. Fremont, in 1841.

This first expedition began in 1842. He left Washington for St. Louis, and by steamboat, pushed up the Missouri River Incidentally, it was on this boat trip that our pioneer made the acquaintance of Kit Carson, famous mountaineer and guide of that day. Twenty-one French-Creole voyageurs made up the party, besides a topographical assistant, a crack hunter, together with Kit Carson, and Fremont as the head.

Well supplied with scientific instruments and other paraphernalia, this first expedition left the mouth of the Kansas in June, proceeding up the Big Blue, and Platte valleys, on to South Pass. The journey was one of hardships, and, at night, the wagons and carts were placed in a circle as a barricade, and the horses were picketed, to guard against the attacks of hostile Indians. It was also on this first expedition that the first India-rubber boat was used, which well reminds us of the one used by Admiral Byrd when he had to land off the coast of Ireland, on his non-stop trip over the Atlantic.

On this trip the weather, vegetation animal life—and above all, the geology, of the country passed through was recorded. Their journey took them up the Platte River to Fort Laramie, a trading post then of the American Fur Company. After that, they penetrated to the Wind River Mountains, and ascended the highest peak there—13,750 feet, which is now called Fremont Peak. The famous explorer wrote: "We mounted the barometer in the snow of the summit, and fixing a ramrod in the crevice, unfurled the national flag to wave in the breeze where never flag waved before—and, standing where never human foot stood before felt the exultation of first explorers!" How awed, and yet how proud, Fremont must have felt! To be the **first** to ever step a foot on such virgin ground! But all virgin ground is not yet gone—no, not by a long ways. There are still many, many areas, creek-beds, mountain and hill sides waiting for some mineral-interested person to take from them the wonderful surprises from behind their seemingly innocent walls!

In May, 1843, this time with twenty-nine frontiersmen, and Kit Carson, Fremont entered upon his second expedition into the Western territory. He proposed to go through South Pass, again, and on to the country about the lower reaches of the Columbia River. He had thought of being away for only eight months, but it was fourteen months before he set foot again in St. Louis, where he had left his wife, and her father.

Kansas City, then only a small village, was the general rendezvous, and here he and his party waited several weeks for the prairie grass to strengthen. Only a few days following his arrival there, however Fremont received a letter from his wife, who urged him to proceed at once to Bent's Fort, on the Santa Fe trail, in southern Colorado—far beyond the frontiers of civilization! This was a long march—seven hundred miles westward, with incomplete preparations, and meager grazing. His wife had given no explanations, and he tells in his later "Memoirs", that he marvelled at the reason for such a sudden move; but Fremont promptly obeyed, for he had much confidence in his wife's judgment. Upon his return home, the following year, he learned the reason for this strange request of hers, which was:—Fremont had ideas of his own, which suggested of his wanting to set up a Western empire, such as had been attempted by another man before, who failed. The Secretary of War heard of this, through indirect sources, and told him to return at once

to Washington. Fremon't wife heard of this, also, and sent, in hot haste, a messenger to her husband, to go further on because then he would be beyond the connections by mail, and could not receive the Secretary's letter—thus, being in ignorance of the command to return home So did Jessie Fremont save the West; but for her the expedition would have had to come back to Washington!

To go on now—Fremont did as his wife bid him to. To Fort Bent, thence northward to St. Vrain's Fort, and north of Long's Peak, he forced a new pass through the outlying barrier hills, to the Bear River, crossing over to Columbia, and reaching the Pacific in November, having scientifically examined and mapped the whole intervening territory!

After leaving Oregon settlers, Fremont, regardless of the oncoming winter, turned southward again to the Sacremento, as he hoped to obtain supplies at Sutter's Fort, in that valley, for their homeward journey. The topography of this vast region was quite unknown—deep snows, rugged mountains, appalling precipices, awsome canyons, weary climbing, and many more hardships were experienced. Indians refused to serve as guides anymore, in such a dangerous region. Horses and men both succumbed to the situation—Indians stole the horses, members of the party died, and the remaining men were compelled to eat the flesh of their mules to keep from starving! But through all of this, Fremont and his few men still stuck and fought their way to their goal—truly they were pioneers!

Finally, in March, this little, struggling band descended from the mountains into the bright sunshine of the Sacremento Valley. They had won! As a reward for his undulating and gallant services Fremont was appointed Captain, by brevet, in the U. S. Army!

When, in 1844, Fremont arrived back in Washington, war with Mexico was threatening. The next spring, 1845, he was sent on a third expedition to further explore the California region, and, as a secret mission, to gain position of that now valuable state of the Union, which was then under Mexican control. He received permission from Castro, the Commissioner then, to continue his surveying. Castro later sent orders for him to leave the country, as he was hearing things too. Fremont refused. He camped at the summit of the Sierras, overlooking Monterey, put up a rude defense of logs, and raised the American flag! Castro did nothing, so Fremont moved his explorations onward.

One evening, in May, while Fremont was standing at his campfire, a messenger rode into the circle exhausted—no, it was not another letter from his wife. But instead, it was a note from General Gillespie, and it said that the crisis with Mexico had almost been reached. Fremont broke camp at once, and retraced his trail to California. He settled at the Buttes, which soon became a gathering place for American settlers there, and around. On June 14, 1846, the insurgents led by Ezekiel Merritt, seized Sonoma, and raised a flag carrying a red star and a bear on it—the Bear flag, on which were printed the words "California Republic". Had this empire idea been sucessful after all? Fremont accepted the leadership, as governor, after the conquest of southern California.

Soon, however, General Kearney arrived, under orders of the U. S. Government, to found a provincial, civil government. A controversey arose, Kearney won, and Fremont was deprived of his position.

Fremont's fourth expedition was to find a route for a railway—since there was none in all the western territory at that time. The dying of several men in the party and other trials, compelled him to quit, and, after he had lost all of his equipment, and a third of his men had died, he finally reached Southern California again. It was after his return tha he became a Senator, though for only one year.

The fifth, and last, expedition was the opening of Immigrant Gap Pass, now used by the Southern Pacific Railway, as the break through the mountains, to connect the West with the rest of the United States. On this journey, the men lived for **fifty** days on **horseflesh,** and even went for **forty-eight** hours without food once.

After the Civil War, which Fremont also took a part in, he lived on Staten Island, though his heart yearned for the West, to which he had become to call home. In 1878, at the ripe old age of 65 years, he served as Governor of Arizona—his last public office. By act of Congress, he was re-appointed major-general (which had been taken from him over the Kearney controversy), on the re-

tiring list, in 1889. Two years before however, he had written his "Memoirs" which is one of the most interesting books ever written by any American explorer. On July 13, 1890, our famous pathfinder died in New York City.

This hardy pioneer was of the most helpful of American explorers, in that he built as he went, and it is on account of the many roads and trails that he made, that he has come down to us in history as the great Pathfinder of the West.

Fremont was among the first to study the geology of the great West scientifically, and to record his findings. And, like Fremont, every collector, Junior or otherwise, has the chance to open new trails to the land about him, for the science of geology, mineralogy, and allied sciences, by taking this hobby of collecting to heart, and helping to boost it in the minds of others; and, also, by prospecting over hills, creek-beds, mountain sides, mine dumps, and even a glacial moraine, becoming acquainted with his locality, and introducing it to others. In this way, perhaps, Junior Collectors may become our future "Fremonts", and do more important things in the future.

What better way of leading one's life is there, than by practicing our hobby, hiking in the outdoors, enjoying this great world and its richness, and making for a healthier mode of living? The more you practice this hobby of mineral collecting, the more you want to keep it up, and go further into its joys. Here's three rising cheers right now for it!!!

Another little biography will be in the next issue, and if you like this one, tell your friends about it, and try to get them to take our fine magazine, that they may become more established in their hobby. To the five best letters received, telling us how their senders enjoy this article, each shall receive free, postpaid, a fine mineral specimen for their own collection. Come on, all of you, and try to be among those first five! This department is for Junior Collectors only, so write in now and the five best letters will receive their prizes promptly—and, may even be printed in the next issue, if we have space. Hurry!

Editor's Note:—Juniors, send all your letters direct to Mr. McKinley, 730-B, 4th Ave., Peoria, Ill.

Club and Society Notes

The Chicago Gem Collectors Society

Founded for the purpose of bringing into closer relations of friendship all those who have more than a passing interest in one of the earth's most beautiful specimens, the Gem; for the promotion of a specified method of identification of its many species and varieties; and for the promotion of the practical knowledge of the applied art of the lapidist, the Chicago Gem Collectors Society was organized on February 28, 1933.

The officers are: President, August Rassweiler, 159 N. State St., Chicago; Director, Hubert Fisher, 31 N. State St. Chicago; Secretary, Wm. F. Tieman, 2047 Bissell St., Chicago.

The Society extends a cordial invitation to every reader of ROCKS AND MINERALS to attend its mid-day educational meetings—free of fee—which are held each Saturday at Rooms 1617-18 Capitol Building, 159 N. State St., Chicago.

Crystal Mineralogy Club

This little club, now three years old, consists of a group of young men all of whom are Junior Members of the Philadelphia Mineralogical Society. Meetings are held every two weeks, at some members home, where papers are read and discussd on new mineralogical localities, crystallography, geology and general scientific nature. Albert Ackoff, 600 E. Wensley St., Philadelphia, Pa., is corresponding secretary.

Stamford Scout Mineral Club

The first scout mineral club to be called to our attention is the Stamford Scout Mineral Club of Stamford, Conn.

It has been in existence for a number of years and was organized primarily for the benefit of those Boy Scouts that have intentions of passing the Mining Merit Badge.

The requirements for membership are: any Boy Scout or Scout official from the age of 17 years that is interested in and intends to make a study of minerals and rocks.

The meetings of the Club are held once a month or at the call of the Advisor. Numerous hikes to quarries and mines in the neighborhood have been taken. Numerous exhibits of the club's collection of specimens have been displayed in store windows and in the public library of the city.

A Junior Division has recently been organized for admitting boys of 12 years (Scout age) who show an interest in mineralogy. Their meetings are held weekly, after school, when instructions are given them by Senior members or by the Advisor of the Club. Hikes are sometimes taken to quarries and other localities for the purpose of collecting specimens. When a Junior attains the age of 17 years, he is advanced to the Senior Division. It has been found most successful in having these two divisions. For at meetings of the Junior or beginner's Division the discussions are mainly on the ability to identify the common rocks and minerals while at the meetings of the Senior or advanced Division the discussions are often on the rarer elements or on the geology of certain localities.

Samuel C. Brown, 14 Fifth St., Stamford, Conn., is the Club's Advisor and will cheerfully give any further information concerning the Club's activities to those who may be interested in forming similar clubs in their cities.

Northwest Mining Association Convention

The 38th Annual Convention of the Northwest Mining Association was held at the Spokane Hotel on the 15, 16 and 17th of December, 1932.

The ore exhibits were very small compared with former years due to the depressed condition of the metal mines Very excellent papers were read, together with interesting talks and discussions on various problems of the mining industry. The attendance was good and the convention a success in all respects.

The opening session in the forenoon of the 15th was devoted to addresses of welcome and a paper on oil and gas at Payette, Idaho.

The afternoon of the 15th and the forenoon of the 16th were devoted wholly to gold.

The afternoon of the 16th was devoted to the present deplorable silver situation. Never in history has silver been at such a low price, below 25c an ounce.

The last day was devoted to financial problems, general mining problems, and resolutions, after which the convention was closed.

The Northwest Scientific Association Convention

The ninth annual convention of the Northwest Scientific Association was held at the Davenport Hotel, Spokane, Washington, on December 28th and 29th 1932. The attendance was good and excellent papers, talks and discussions were presented in the various sections by educators from various institutions of higher education in the Pacific Northwest States of Montana, Idaho, Oregon, and Washington.

The forenoon of the 28th was devoted to a general session of all sections. On the afternoon of the same day the sectional meetings commenced. The geology section was well-attended that afternoon and the forenoon of the next day being devoted entirely to a discussion on "The Batholiths of the Northwest". Very excellent papers, followed by talks and discussions, were presented on this subject. The afternoon of the 29th was devoted to general subjects on geology and paleontology.

The symposium for the 1933 convention will be "The Major Structure of the Pacific Northwest".

New York Academy of Sciences, Section of Geology and Mineralogy

At the meeting of April 3rd, Dr. George W. Bain, of Amherst College, who has spent much time in studying the Vermon marbles, gave an illustrated lecture on the geology of central Vermont. He explained in detail the geologic structures involved in the area, and their relation to the formation of the marble. The importance of working out the detailed structure of the formations in connection with the economic developments

of the marble quarries was pointed out. In addition to lantern slides, Dr. Bain showed moving pictures, dealing largely with the marble quarries and cutting plants.

New York Mineralogical Club

On Wednesday, April 19th, Mr. Samuel George Gordon, Associate Curator, Department of Mineralogy, Academy of Natural Sciences of Philadelphia, gave a talk on "The Fourth Academy-Vaux Mineralogical Expedition: Across South America and Africa". The talk was largely in the nature of an illustrated travelogue, covering the tin, copper, silver and platinum deposits of Peru and Bolivia, and the diamond, copper, and gold deposits of Africa. Mr. Gordon displayed a most remarkable collection of colored lantern slides, illustrating mining activities and the country traversed.

Mr. Morton, of the Paterson Museum, displayed some specimens of blue quartz, zircon, and rutile from Nelson County, Virginia.

Mr. Manchester reported on the proposed field trip of the New York Mineralogical Club to the Bedford quarries on Memorial Day, and advised the club that it will have the aid and cooperation of Mr. Jeffries, the manager of the quarries.

Official Organ ROCKS AND MINERALS

Oregon Agate and Mineral Society

Meets every 1st and 3rd Fridays at Chamber of Commerce Bldg. Portland,Ore.

Officers

Pres., Dr. H. C. Dake, 2385 N. W. Thurman St., Portland
Vice-Pres., Dr. E. W. Lazell, 537 Railway Exchange Bldg., Portland
Sec.-Treas., Mrs. Mabelle V. Gordon, 501 Couch Bldg., Portland

The Oregon Agate and Mineral Society which held its first meeting January 20th, 1933, has grown and spread beyond all expectations of its organizers. The interest shown locally as well as throughout the state of Oregon and adjoining states has been most gratifying.

The average attendance is from one hundred fifty (150) to two hundred (200) people and our programs are exceptionally interesting, being supplied with speakers who are experts in the agate and mineral industry of Oregon.

Mr. Roy C. Andrews, Instructor of Chemistry in one of our high schools, Mr. F. Young, in charge of our Sales Department and an Iris agate expert, and Mr. Norman G. Seaman the best known authority in the northwest on Indian relics have recently lectured before the Society.

On the 7th of April, we closed our charter with a membership of seventy-six (76). One of the pleasing features of this Society was a get-to-gether-acquainted dinner which was well-attended and resulted in much good to the Society both in a financial and social way.

Our Caravan committee has been hard at work over the week-ends searching for good localities for the Society to visit and find out what Mother Earth has hidden under our feet.

We are very proud to announce the fact that we register as the second largest local mineral society in the world.

The Oregon Agate and Mineral Society appreciates very highly the publicity it has been given through the ROCKS AND MINERALS Magazine and it will in turn repay by giving this national educational magazine its loyal support.

Great Boulders of the World

ROCKS AND MINERALS would be glad to receive notes from its readers relative to large boulders known to them with the hope of locating the largest one known. Please note that in every case the specimen must be a water-worn boulder and not a slab broken off from a cliff. To be considered your notes must state the type of rock the boulder is composed of, its measurements, and its location.

Editor R. & M.:—

I enclose a snapshot of a large boulder that is located near the Greenwich line in Stamford.

The dimensions are 18x15x15 feet. Composition granite with quartz veins. A large vein of quartz may be noticed in the photo.

READY TO ROLL
Boulder on edge of ravine.

The boulder rests on a worn ledge of biotite gneiss and shows evidence of being water-worn. There are quite a number of smaller boulders in this section.

SAMUEL C. BROWN,
Jan. 7, 1933. Stamford, Conn

Editor R. & M.:—

Noticing your call for notes on boulders, I would say that the Madison Boulder, a few miles from the main auto highway in Madison, N. H., is locally claimed to be the largest in North America. It is an isolated, water-worn boulder not a mass broken from a cliff, and measures 90 feet in length, 40 feet in width and 40 feet in height. Railed steps provide a means of climbing to the top. It is several years since I saw this great rock, and I have no information as to its composition. E. R. CHADBOURN,
Jan. 2, 1933. Melrose, Mass

Editor R. & M.:—

I was interested in your recent query relative to boulders and am sending a little snapshot of a balanced granite boulder located about 20 miles from my home at a place called Yava. This rock I estimate to be at least 20x14x14 feet and to weigh perhaps 200 tons or more. It is small, however, compared with others here but which are not of the balanced variety. This particular part of the state bears mile on mile of these rounded granite boulders and in places they are piled one on top of another with pyramidal structure perhaps as much as 100 feet in height. Little shrubs and trees grow among them and present a spectacle of much beauty and grandeur.

Some balanced rocks here are as small as 2 feet in diameter and are almost perfectly spherical.

I wish some of our mineralogical friends would show up here while I am still on the ground.

G. W. CUTLER,
Jan. 10, 1933. Skull Valley, Ariz.

Bibliographical Notes

Ward's Mineral Bulletin:—Vol. 1, No 1, February, 1933, 4 pages. A delightful surprise was presented to those mineral lovers who were favored with copies of this new and unique little publication This is to be a house organ of Ward's Natural Science Est., Inc., P. O. Box 24 Beechwood Sta., Rochester, N. Y., and its purpose is to reach all those interested in the fascinating study of mineralogy, and to keep them informed as to the aims and ideals of the mineral branch of the Establishment and at the same time keep them posted regarding the Establishment's accessions, many of which are of great interest. Every collector should write to Ward's and have his name placed on their mailing list. The **Bulletin** will be issued free.

Getting Acquainted with Minerals:—By George Letchworth English. Two little study leaflets, Nos. 1 and 2, have recently been issued by Ward's Natural Science Establishment, Inc., for the beginning student of mineralogy. The leaflets are very interesting and instructive and give in a clear, concise and elementary manner much information of value to those who know little about the fascinating study of mineralogy. The leaflets are free and may be had on application.

British Coals-Origin, Composition and Classification:—By A. L. Curtis, SANDS CLAYS AND MINERALS, (Chatteris, England) Vol. 1, No. 3, January, 1933, pp. 65-75, 1 colored supplement. This is an interesting article on coals in general and those of Great Britain in particular. In the editorial of the same issue, the point is brought out that coal is the only exportable mineral Great Britain possesses in great quantity. Consequently it is not surprising to learn from the article that practically every variety of coal used commercially is mined in the British Isles.

Meteorite Craters as Topographical Features on the Earth's Surface:—By Dr L. J. Spencer. THE GEOGRAPHICAL JOURNAL (London, England), Vol. LXXXI No. 3, March, 1933, pp. 227-248, 9 plates, 3 figs. A valuable paper presenting in an interesting manner facts relating to all the known and suggested meteorite craters that have been recorded. Prior to 1927 only one meteorite crater was known, the "Meteor Crater" in Arizona. Since that time at least five have been found throughout the world in Texas, Argentina, Australia, Arabia and Siberia. One of the purposes for writing the article is to give some account of the few meteorite craters or supposed meteorite craters that have so far been discovered in the hope that the scanty information at present available may be of some help to travellers in recognizing further examples.

Origin of Tektites:—By Dr. L. J Spencer, Nature, (London, England), Vol. 131, p. 117, January 28, 1933. Tek tite is the name for a group of glassy materials of which examples are moldavites, australites and Darwin glass whose origin was long in doubt. Dr. Spencer believes they have been formed by the fusion of terrestrial rocks, especially in sandy deserts, by the heat developed when a large meteorite comes in contact with them.

The Gem Minerals of San Diego County, California:—By E. V. Van Amringe. Bulletin of the Mineralogical Society of Southern California. Vol. II, No .7 March, 1933, 4 pages. Over two and one-quarter millions of dollars worth of gems have been found in California since 1900 and San Diego County is the leading gem district. The gems found are listed alphabetically in the article with brief descriptions of important localities.

Annual Report of the Quebec Bureau of Mines for the Calendar Year 1931 (Quebec, Canada.) Two bulletins have recently been issued as follows:—

Part B-128 pps., 5 plates, 9 figs., 1 map.

Granada Gold Mine and Vicinity, Rouyn Township, Temiscamingue County, by J. E. Hawley 3

Bell River Headquarters Area: Detailing the Pascalis-Louvicourt Gold Deposits, by L. V. Bell and A. V. Bell 59

Part C-79 pps., 2 plates, 3 geological maps.

Lake Ostaboning Map-Area, Temiscamingue County, by J. A. Retty 3

Geological Exploration on the North Shore, Forestville to Betsiamites, by Carl Faessler 17

The Bonnecamp Map—Area, Gaspe Penninsula, by I. W. Jones 41

Dealers and Manufacturers Department

Each item given below contains information of value to readers. For further particulars apply directly to the firms and please mention ROCKS AND MINERALS when writing.

Inexpensive Minerals:—Price List No 359, February, 1933. A new price list of 38 pages covering inexpensive minerals has recently been issued by Ward's Natural Science Est., Inc., P. O. Box 24 Beechwood Sta., Rochester, N. Y. An entirely new arrangement has been adopted in this price list, the purpose of which is to facilitate the selection of such groups of minerals as the student finds it most desirable to purchase and study. The prices of many items are so low as to tempt even the most casual of buyers. If you haven't a copy of this price list, send for one immediately before the supply is exhausted.

Price List of Mineral Specimens from San Diego County, California:—In conjunction with the Bulletin of the Mineralogical Society of Southern California Vol. II, No. 7, March, 1933, John M. Grieger, 405 Ninita Parkway, Pasadena Calif., has issued a 4 page price list covering gem stones (both rough and cut) of which he has a large stock. The prices quoted are very reasonable and all those who are in any way interested in gems should have a copy of this price list Send for your copy today—it's free.

A unique price list of 8 pages, neatly bound, and which contains 3 real photographs, is issued by W. Scott Lewis, 2500 N. Beachwood Dr., Hollywood, Calif. The price list contains a wide range of interesting minerals at prices so low that everyone can afford to buy some of them Send for a copy and be convinced. A charge of 15c is asked for the price list which amount will be refunded with first order for minerals from the list.

Price List of Minerals, No. 2. February, 1933, is a one page mimeographed sheet issued by one of our newest dealers, Charles O. Fernquist, 2316 N. First Ave., Spokane, Wash. Many of the specimens are from the northwest and all are priced attractively.

Boodle Lane, Galena, Kansas, is another of our enterprising dealers who has recently issued a new price list. Mr. Lane speciallizes in minerals of the Tri-State District which is the richest lead and zinc area of the world. Not only this, but the district is noted the world over for the excellence of its crystallized minerals—calcite, galena, sphalerite, marcasite, dolomite, and others. In the list just issued, Mr. Lane offers 57 specimens, the majority of which are either crystals or crystallized. And to make his offers especially tempting, a large picture is included in which each specimen is on display. Mr. Lane is also included in the picture. This is indeed an attractive list and the minerals offered are real bargains.

P. S.—Saw your Ad. in Rocks and Minerals

THE CLASSIFIED AD SECTION
of ROCKS and MINERALS

Rate 5 cents per word. No ad accepted under ten words. Remittance must accompany copy in all cases. Closing dates are: 20th of January, April, July and October. All must furnish satisfactory references before their advertisements will be inserted.

FOSSILS

EXCELLENT GRAPTOLITES. SINGLE specimen 10c. Additional on same rock, 5c each. Unsearched slab 25c. Rates on quantities. Mint U. S. Commemorative stamps only or cash. Dr. R. S. Poor, Dept. Geology, Birmingham-Southern College, Birmingham, Alabama.

GEMS

SPECIALIST IN AMETHYSTS FROM BRAzil, violet purple color, suitable for necklaces, rings, brooches, pendants, scarfpins, etc. 40-80 cents per carat. One choice 75 carat specimen (dark, heartshape) $60.00. Citrine (jeweler's Topaz) 30-55 cents per carat. Different shades of color. Also rough gems. Also exchanged for old U. S. coins, old American or English books or ?. Please write your wants in Amethyst Geodes of good quality, Tourmaline crystals, dark green up to 400 grams apiece, rough Aquamarines or ?. Direct importer. Ernest Meier, Rex House, 66 East End Ave., New York, N. Y.

OPAL, VIRGIN VALLEY, NEVADA SPECimen and gem quality for cutting. Also other minerals. Send for list. Chas. O. Fernquist, 2316 W. First Ave., Spokane, Wash.

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P. S.—Saw your Ad. in Rocks and Minerals

First National Outing

-- OF THE --

Rocks and Minerals Association

Sunday, July 9, 1933

(To be held in 18 states and one province of Canada)

The Rocks and Minerals Association extends a cordial invitation to all readers of ROCKS AND MINERALS, and to the general public, to participate in the outing. Members of the Association are urged, not only to be present themselves, but, to bring their friends as well and otherwise advertise the outing to the best of their ability. It is by cooperation and support that the outing may turn out to be a grand success.

All those planning to attend are requested to register with their respective directors. If an answer is wanted to an inquiry, a self-addressed stamped envelope enclosed with the letter would be appreciated by the director.

If those having cars could accommodate one or more extra passengers it would be considered a great favor if they would so inform their directors.

In order to obtain an accurate count of the total number attending the outing, the directors will take the name of each one present. Please cooperate by making certain that the director has your name included.

Except as noted please bring lunch.

Note—Neither the Association nor the directors nor even the owners of property on which outings may be held are to be responsible for any accidents incurred by those participating.

The states in which outings will be held and their directors are as follows:

ALABAMA

Director—Dr. R. S. Poor, Birmingham-Southern College, Birmingham. Head of the Dept. of Geology.

Meeting Place — Birmingham-Southern College Campus at 9:00 A. M.

Localities—1. The Irondale Quarry. 2. Green Springs Cut.

Specimens—1. Ordovician fossils and pink calcite. 2. Fossiliferous and oolitic hematite; and molds of Pentamerus Oblongus (the so-called fossil hickory-nuts).

ARKANSAS

Director—Miss Koleta E. Walker, Newark. Owner of Koleta's Kurio Kabin.

Meeting Place—Office of the Secretary of the Chamber of Commerce in Batesville at 9:00 A. M.

Localities—1. Manganese mine at Cushman, 10 miles from Batesville. 2. Lime kiln at Limedale. 3. Marble quarry at Batesville.

Specimens—1. Psilomelane, pyrolusite etc. 2. Fossils. 3. Marble. Outcrops of ochre, diatomaceous earth, etc. will be studied.

CALIFORNIA (The Bay Region)

Director—John Melhase, 675 Vincente Ave., Berkeley. Geologist.

Meeting Place—At the director's residence at 8:00 A. M.

Localities—The area around Lower Lake.

Specimens—Hyalite, amethyst, glaucophane, tridymite, and others.

SOUTHERN CALIFORNIA

Director—Herman Abraham, 2464 Sterling Place, Altadena. Chairman of the Field Trip Committee of the Mineralogical Society of Southern California.

Meeting Place—At the lighthouse in Palos Verdes Estates at 10:00 A. M. Take boulevard south from Redondo Beach.

Locality—The cliffs above the ocean at the Palos Verdes Estates.

Specimens—Good quality barite crystals.

COLORADO

Director—Wayne W. Ward, 618 N. Weber St., Colorado Springs. Secretary of the Alpine Club of Colorado Springs.

P. S.—Saw your Ad. in Rocks and Minerals

Meeting Place—In front of the Colorado Springs Public Library at 8:15 A. M.

Locality—The famous zircon locality of St. Peter's Dome, and others.

Specimens—Zircon, riebeckite, microcline, quartz, etc.

Special—The director will provide a lunch at 40c each but those who desire it must write to inform him of this intention.

IDAHO

Director—Julian M. Field, Payette. Editor of "The Sundial".

Meeting Place and Localities — Please write to the director for particulars. Several interesting trips are planned.

ILLINOIS

Director—Ben H. Wilson, 112 Mississippi Ave., Joliet. Instructor in Science, Joliet Township High School and Junior College (Assisted by Frank L. Fleener, So. Park Road, Joliet).

Meeting Place—Joliet Township High School building, corner Jefferson and Eastern Ave., at 9:00 A. M.

Localities—A visit to the stone yards of Adam Groth; and the plant of F. E. Schundler & Co., specialists in grinding and processing minerals. Important features of the "Lakes-to-Gulf" waterway will also be viewed.

At 1:00 P. M., from the same meeting place, the party will drive to the collecting grounds of the famous Mazon-Creek coal measure sandstone.

Specimens—Concretionary nodules of beautifully preserved fossil plants.

MAINE

Director — Leonard H. Starbird, 19 Craggmere Ave., So. Portland. President of the Maine Mineralogical and Geological Society.

Meeting Place—Meet at the locality about 9:00 A. M. Those leaving from Portland may meet at 22 Elm St. (The Portland Society of Natural History).

Locality—The W. D. Nevel Quarry on Hall's Ridge at Newry, Me.

Specimens—Colored tourmalines, beryl, rose quartz; and many of the rarer minerals including radioactive ores as uraninite, torbernite, etc. The list is too long and hence only a few are given.

MARYLAND

Director—Dr. Mark H. Secrist, the Johns Hopkins University, Baltimore, Md. Head of the General Geology Department.

Meeting Place—Latrobe Hall, the Johns Hopkins University, at 8:00 A. M.

Localities—Rock and mineral localities along Jones Falls as far north as Bare Hills; and the Cockeysville-Texas marble district, including an inspection of a marble cutting mill.

Specimens—About 50 different minerals. Among the more common are: chalcedony, chromite, epidote, tourmaline and tremolite.

MONTANA

Director—A. J. Harstad, 15A Kohrs Block, Helena. Mineral dealer, owner of The Gem Shop.

Meeting Place—The Lexington Mine in the Scratch Gravel District, 8 miles N. E. of Helena at 9:00 A. M.

Localities—Old mines of the Scratch Gravel District.

Specimens—Various silver and copper minerals, garnets, and snipe for gold.

NEBRASKA

Director—V. K. Overman, 2332 So. 11 St., Omaha. Director Omaha Camera Club.

Meeting Place—Lobby of the Y. M. C. A. at 17th and Harney Sts., at 9:00 A. M.

Locality—The Zwiebel Farm.

Specimens—Flint nodules, pyrite crystals, and various fossils. Exposures of Carboniferous and Cretaceous rocks will be studied.

Notes—A charge of 50c is levied against each car, as the locality is on private property. The director will furnish coffee.

NEW YORK—NEW JERSEY

Director—Fred W. Schmeltz, 2510 Maclay Ave., New York, N. Y.

Meeting Place—All will meet at the locality at 11:00 A. M.

Locality—Pyrrhotite mine on Anthony's Nose, near Peekskill, N. Y. (see article in this issue for directions, specimens, etc.)

NORTH CAROLINA

Director—Mark Sheppard, Spruce Pine.

Meeting Place and Locality—Please write to the director for particulars.

OREGON

Director—F. S. Young, 501 Couch Bldg., Portland. Publicity director of the Oregon Agate and Mineral Society.

Meeting Place—At the locality at 8.00 A. M. Those leaving from Portland meet at the corner of 4th and Couch Sts., at 4:00 A. M. In Antelope meet at John Silvertooth's Store.

Localities—Antelope, then later to Sunflower Flats.

Specimens—The beautiful agates and geodes for which Central Oregon is famous.

SOUTH DAKOTA

Director—Mrs. Edna M. Scott, Box 44, Custer. Owner of the Scott Rose Quartz Mine.

Meeting Place—All will meet at the **Log Cabin** at the locality at about 1:00 P. M. Take Highway 36 leading from Custer through the State Park until the Tallent Monument is reached at a distance of 3 miles. See sign there pointing to road to Rose Quartz Mine which is 7 miles further.

Locality—The Scott Rose Quartz Mine, 10 miles S. E. of Custer.

Specimens—Rose quartz, beryl, mica, and others.

Note—The director will serve coffee to those bringing lunch. Light lunch, ice cream, etc., may be purchased on the grounds.

TEXAS

Director—Clarence L. Brock, 2519 Taft St., Houston. Director-secretary of the Houston Museum of Natural History.

Meeting Place—At the locality or write to the director to arrange.

Locality—The famous Barringer Hill (see article, A Trip to Barringer Hill, by C. L. Brock, ROCKS AND MINERALS, June, 1932, Vol. 7, No. 2, p. 54).

Specimens—Many rare earth minerals.

Note—The director is leaving Houston on July 8th to reach the locality. Those desiring to accompany him please write Mr. Brock.

UTAH

Director—Junius J. Hayes, 1148 E. 1st South, Salt Lake City. Consulting and Analytical Chemical Engineer.

Meeting Place—On the lawn of the L. D. S. Business College in Salt Lake City at 8:30 A. M.

Locality—Mueller Park, one hour drive from the city.

Specimens—Many non-metallic minerals.

WASHINGTON

Director—Charles O. Fernquist, 2316 W. First Ave., Spokane. Curator of mineralogy at the Public Museum in Spokane.

Meeting Place—At the Museum, 231 W. First Ave., at 8:00 A. M.

Localities—1. Visit the mineral collection at the museum. 2. The Cleveland Mine.

Specimens—Lead and zinc ores, boulangerite, arsenopyrite, and many others (see article—Boulangerite and Associated Minerals of the Cleveland Mine Stevens County, Wash., by Charles O. Fernquist, ROCKS AND MINERALS, March 1930, Vol. 5, No. 1, p. 6).

WISCONSIN

Director—Benedict P. Bagrowski, 172 So. 22 St., Milwaukee. President of the Milwaukee Geological Society.

Meeting Place—In front of the Milwaukee Public Museum at 7:00 A. M.

Localities—The historical iron localities of Iron Ridge and Utley. Other places may also be visited.

Specimens—Hematite and other iron minerals.

CANADA (Ontario)

Director—James Campbell, Hybla, Ontario, Canada. Miner and Prospector.

Meeting Place—At the Bancroft Hotel in Bancroft, Ontario, at 10:00 A. M. Take No. 2 Highway from Belleville.

Localities—The well-known feldspar mines and quarries of Hybla.

Specimens—A great number of minerals associated with pegmatite including radioactive varieties.

Note—It is suggested that those coming from a distance arrive July 8th staying overnight at Bancroft. Members and friends residing in up-state New York are cordially invited.

Respectfully submitted,

FRED W. SCHMELTZ,

National Director of Outings,

2510 Maclay Ave.,

May 1, 1933. New York, N. Y.